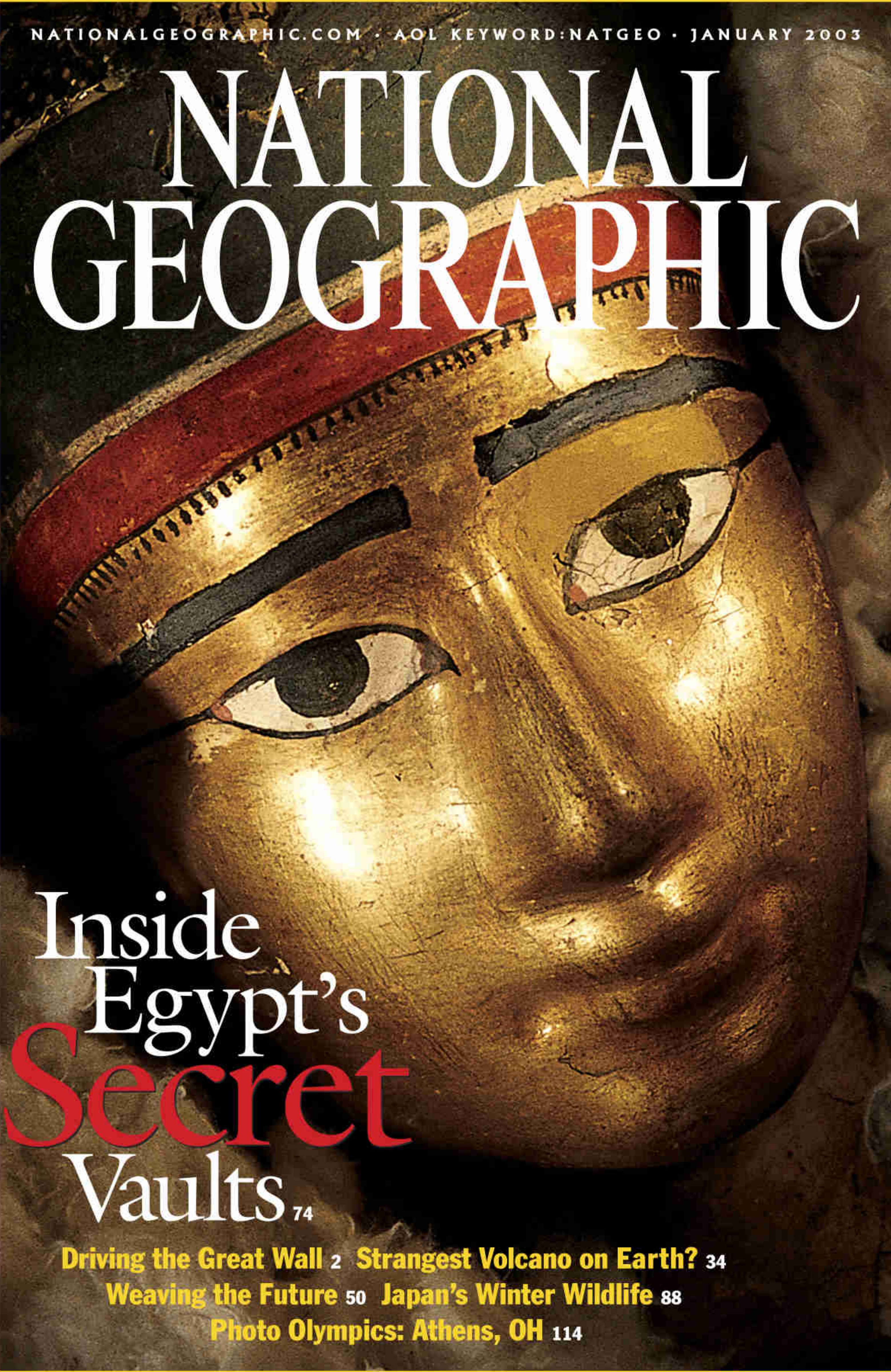


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NATIONAL GEOGRAPHIC



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Flashback

THE COVER

Once hidden from public view, an ancient gilded death mask emerges from a box in the basement of the Egyptian Museum.

BY KENNETH GARRETT

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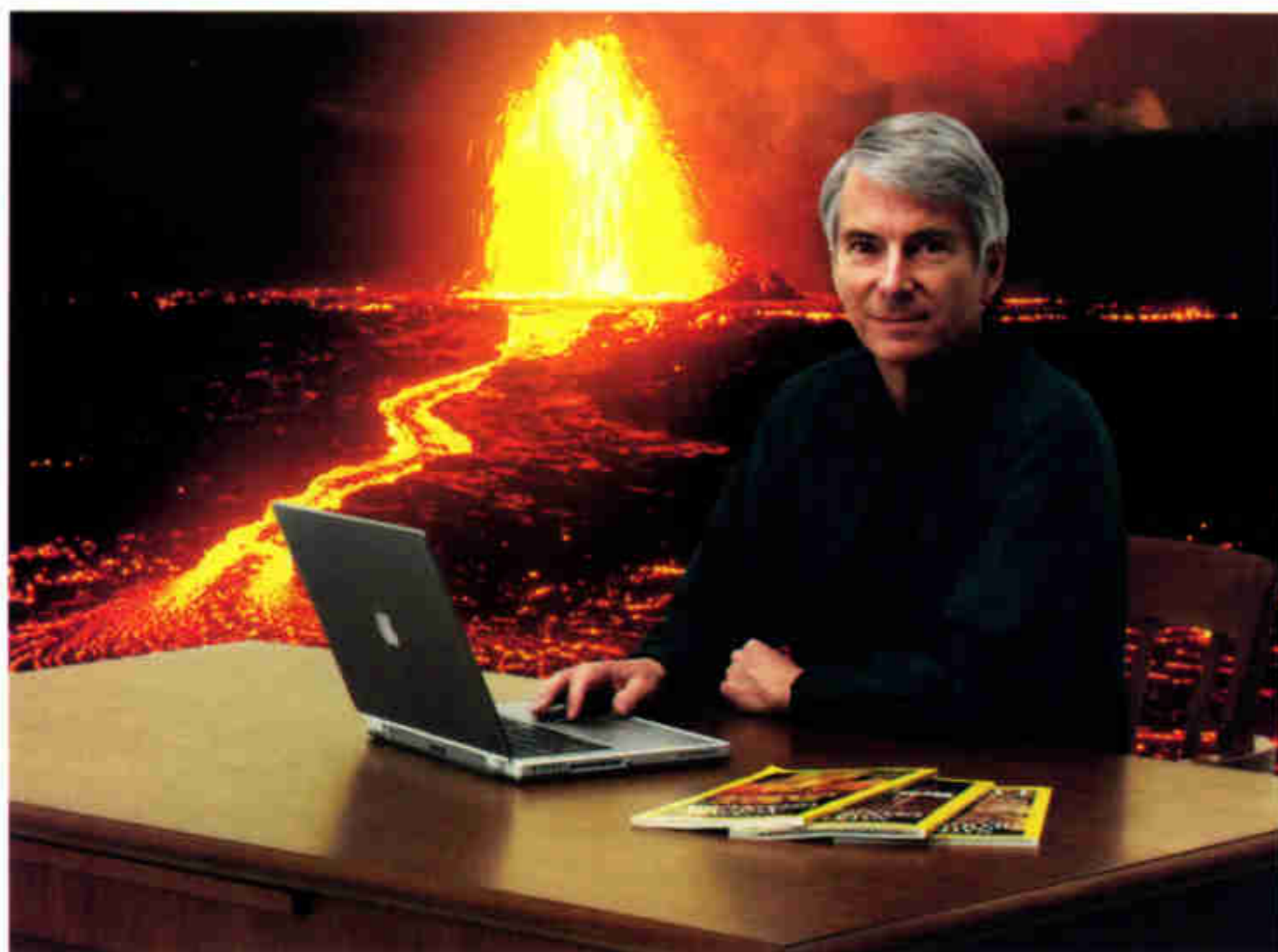
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ROBERT W. MADDEN AND MARK THIESSEN, NGS

Quick, how can you tell that this image has been altered? (Other than the fact that my desk is clean, that is.) The implausible background helps, but it's seldom this easy.

The technology exists to let us watch a man swing around New York on spider silk and a young wizard fly on a broom, yet no one (I hope) confuses movie fantasy with reality. Similar tools make it possible to bend reality in photos. So how do you know if you're seeing a manipulated picture? Problem is, sometimes you can't.

Disclosure of image manipulation is essential, although defining what counts as manipulation is a challenge. Removing scratches and dust from film doesn't alter content—beyond that, people draw the line in different places. Our policy: Altering the content of photos in NATIONAL GEOGRAPHIC is unacceptable. Any exceptions must be explained so that readers won't confuse those images with the documentary photography that's our mainstay.

The high-tech textiles article beginning on page 50 is one of those exceptions. Photographer Cary Wolinsky used multiple exposures and digital distortions, and combined several images into one to help us visualize the stunning potential of high-tech fabrics, some of which don't even exist yet. In this case, what you see is what you *might* get.

Bill Allen



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GET THE FEELING

TOYOTA

Forum

September 2002

Many readers of "State of the Planet" and "Water Pressure" blame overpopulation for dwindling natural resources. "We're told to conserve," wrote one reader. "But conserve for what? So a burgeoning population can outstrip our most valiant efforts?" Others wonder if the threat of overpopulation is exaggerated, citing recent reports that fertility rates have stabilized—or even dropped—in parts of the world.



Shrinking Great Lakes

You provided water level data that only go up to 2000, which we all remember as a "low" year. But you provide only a dismissive admission that water levels have gone up since then. Public data show that in early 2002 Lakes Huron and Michigan were about 0.4 meters [1.3 feet] below their long-term historic average but above their all-time low. In August they were up about 0.3 meters from 2001. Lake Superior has tracked just 0.1 meters below its long-term average throughout 2002. Same for Lake St. Clair, the "poster child" for low lake levels. The only conclusion from over 140 years of data on water levels is that the water levels are variable. They always have been, and they always will be. There is no evidence to suggest that there is a long-term trend downward that can be extrapolated into the future.

EDWARD M. KARLS
Ann Arbor, Michigan

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There are natural patterns to the rise and fall of the lakes, but as a Michigan resident I can say with confidence: Recent changes aren't natural. I've lived here since 1961, and there was a perceptible change in the weather patterns in the second half of the 1980s. The summers are about the same, but winters have largely stopped coming or are mild. Without snow and ice these northern lakes are doomed to shrink and dry.

JACK WRIGHT

Waterford, Michigan

FROM OUR ONLINE FORUM

nationalgeographic.com/ngm/0209

The author attributes declining water levels to decreased precipitation, increased evaporation, and high consumption. These primary causes are exacerbated by continued uplift of the local topography. When vast continental glaciers overlaid the region, the great weight of the ice depressed Earth's crust by up to 300 meters. When the glaciers retreated 11,000 years ago, the area began the slow process of isostatic rebound, which continues today. Rebound rates in the region are as high as a quarter centimeter per year—small numbers that are significant



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Ethiopian Wolf (*Canis simensis*)

Size: Head and body length, 100 cm; tail, 33 cm **Weight:** Female, 11.2 - 14.2 kg; male, 14.0 - 19.3 kg

Habitat: Isolated pockets of grassland and heathland in Ethiopia's mountains, at elevations above 3,000 meters; the largest population is in Bale Mountains National Park **Surviving number:** Estimated at fewer than 500



Photographed by Claudio Sillera

WILDLIFE AS CANON SEES IT

Ravaging wolf pack. Wolf in sheep's clothing. Such fearsome stereotypes plague the Ethiopian wolf, falsely labeled a threat to lambs. In reality, the world's rarest canid hunts alone, preying largely on hares and rats. And its blood-chilling howl, which carries up to five kilometers, is merely a means of long-distance communication. Territorial packs of two to 12 congregate at morning, midday and evening, and all members

cooperate to guard and provide food for the dominant female's pups. Their mountainous haunts once offered some solitude, but are now growing inhospitable with the arrival of high-altitude farms and domesticated dogs.

As an active, committed global corporation, we join worldwide efforts to promote awareness of endangered species. Just one way we are working to make the world a better place—today and tomorrow.



Water Pressure

If every family of four switches its showers from ten minutes to three minutes, the water savings in North America alone would be on the Great Lakes scale.

JEANNE LAMBERT GRAHAM
Bishop's Mills, Ontario

Perfect green lawns in Vegas? Dancing water fountains at the Bellagio? I am counting on the wisdom of our leaders in Canada to *never* agree to the bulk export of our water to feed the excess and waste of our neighbors to the south.

LYDIA REPLANSKY
Ottawa, Ontario

I would be eager to reduce my rate of consumption if I could be certain that the water saved

would be added to the stream flow to support the natural environment of our watershed. But I know that if I reduce my use, the water I save will be sold to new homes in new subdivisions at below cost to subsidize population growth. Future population growth guarantees that our water problems will only get worse.

ALBERT ALLEN BARTLETT
Boulder, Colorado

In Singapore, a nation that has little in the way of natural resources, the government is constantly seeking ways to reduce our dependence on freshwater sources. Desalination is a step in the right direction. However, your article did not address the root of such



PETER ESSICK

problems: Human population may hit nine billion by 2050. No matter how resourceful we are, there will come a time when resources will never be replenished.

JEFFREY LOW
Singapore

Most canal irrigation projects fail farmers in developing countries. Addressing the issue will take more effort than the adoption of the simple devices described. Drip irrigation, however successful in some areas, is not a silver bullet.

HERVÉ PLUSQUELLEC
Washington, D.C.

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when the other factors cited by the author are added in. This is another reason that a static view of the lakes is shortsighted.

MICHAEL BANINO
Jersey City, New Jersey

ZipUSA: New York City

Diana Kane's description of TriBeCa as "adrift" since 9/11 is misleading. I have been a resident since 1973. From the morning of the attack I've been consistently impressed by the courage and resilience of this community. As I look around

WRITE TO FORUM

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the streets of TriBeCa, I see that our wonderful waterfront is again accessible to all. I see new restaurants opening their doors. I see children and family dogs reclaiming the streets. This has been an extremely difficult time for all of us, but we are far from adrift. TriBeCa is in some ways more focused than ever.

CYNTHIA EARDLEY
New York, New York

Meerkats

We have a 21-month-old girl who found the magazine, saw the cover, and exclaimed "Wow!" We showed her the other meerkat pictures, and the September GEOGRAPHIC has become her favorite book. Samantha agrees with Bill Allen: You can never have too many meerkats.

DAVE MORAN
Hamilton, New Zealand

State of the Planet

The "State of the Planet" article leads with the headline "Each day the global population grows by 219,000 people." Beneath the headline is a photo of thousands of people crowded together. We are supposed to believe that we are running out of room, running out of resources, and headed to hell in a handbasket. The reality is quite different. Many of us are living longer, healthier, and freer lives than at any time in history, and the rate of increase in population is slowing dramatically (below replacement level in parts of the world).

ED KELLY
Rolling Hills Estates, California

The majority of the readers of your magazine will probably pass the "State of the Planet" article off as environmentalist



FUNNY, SO DID YOU.



TAURUS

*Taurus SEL interior shown with optional leather-trimmed seating and wood grain package.

on the new 2003 Ford Taurus SEL. Surprised? Well, if you haven't looked at a Taurus lately, look again.

scare tactics. The sad truth is we destroy our planet a little more every day. Global warming, destruction of ecosystems, over-consumption, and prodigious waste are all very real. As civilization destroys nature, we sit blindly in denial.

WILLIAM MILLER
Corona, California

I was quite disappointed with the “people are bad” tone of your map insert. You suggest people use too much energy. Who would you deny the right to better their lives? (Also, keep in mind that any source of even renewable energy, when used in sufficiently large quantity, will impact the environment.) You suggest there are too many people on the planet. Which ones should go? Perhaps you agree with China’s policy of forced sterilization. I think all honest people believe that what we must do is enable people to better their lives while at the same time preserving the planet. It can be done. It is precisely the human capacity to learn that will enable us to achieve both ends.

RON EMBRY, JR.
Houston, Texas

I strongly disagree with the conclusion that nuclear waste is one of the setbacks to the environment. The exact opposite is true! A large portion of nuclear waste comes from nuclear power plants operating around the country that have been built in place of coal-, gas-, or oil-burning electric generators. This switch to nuclear fuel from fossil fuels has substantially reduced air pollution from carbon dioxide, which you identify as a major contributor to global warming.

JAMES E. GINGRICH
Lafayette, California

On the one hand we have the developed world, where atmospheric pollution could be controlled but there is no great will to do it. On the other hand we have the underdeveloped world, where the business of just staying alive is increasingly difficult and the population continues to

You suggest people use too much energy. Who would you deny the right to better their lives? You suggest there are too many people on the planet. Which ones should go?

grow. The truth is that if both continually deny that they are in the wrong, then all the conferences in the world are never going to change things.

BARRY COLLIER
Wisbech, England

You list Global Warming and An Appetite for Oil among the setbacks we face. I find it interesting that you accept ads from auto companies that actively lobbied against raising Corporate Average Fuel Economy standards last year. Raising CAFE standards would reduce greenhouse gas emissions and reduce the U.S. appetite for oil.

MATT TOWNSEND
Vancouver, British Columbia

Who Knew?

In the West we have fewer children now and many survive because we have easily available health care. Therefore, children with less robust immune systems are surviving into adulthood. These people are the canaries in the mine. They react to the chemical and physical assaults we choose to ignore: pesticide, fertilizer, industrial emissions, and food additives. We should be taking note of the coughing and wheezing canaries and cutting out the things that make us wheeze.

CAROLINE KNOWLES
Vegreville, Alberta

Flashback

After working in Europe, I sailed in 1953 from LeHavre on the *United States*. It was announced on the PA that the *Queen Mary* was in sight. We were doing 18 knots, and it seemed that we increased to about 28 knots. We passed the *Queen Mary* and saluted each other with a blast from the whistles. To this day I still chuckle at the idea of two magnificent ships drag racing.

EDWARD E. FARRELL
West Sayville, New York

The photo brought bittersweet memories. My dad, Frank Donohoe, worked on the Westinghouse propulsion system for the *United States*. He was thrilled with the early achievements of the ship and just as disappointed with the tossing away of a great symbol of our sea power. The vessel at the pier in Philadelphia is merely a ghost.

MARY PFEFFERLE
Cheyenne, Wyoming

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ENVIRONMENT

A Dump Reviled, Revered

The debris of 9/11 underlies a reviving ecosystem

The Fresh Kills landfill on New York's Staten Island had been closed for six months when, soon after September 11, 2001, a new stream of barges began delivering debris from the World Trade Center site. The 2,200-acre dump had been the neighbor nobody wanted. When it closed in March 2001, the residents of Staten Island

celebrated the arrival of what should have been the last barge of waste (left) with water cannons and toasts. New York City councilman and Staten Island native Mike McMahon said he felt "relief, pride, and gratitude" when it looked as if Fresh Kills had finally closed.

But with the arrival of the first remains of the towers, the

A P H I C A

C R E A T U R E S O F O U R U N I V E R S E



MICHAEL FALCO (BOTH)

island's embarrassment suddenly became hallowed ground. Says McMahon, "After all, we lost more than 250 members of our community," including 78 firefighters. Workers sifted through 1.6 million tons of debris that was deposited in a part of the landfill that hadn't been closed (above). About 300 victims were identified through evidence found there, though DNA analysis may increase that tally. Eventually a memorial will rise on what became known simply as the Hill.

Could the tons of trash and tragic memories one day become a woodland refuge? Nearly ten

years ago ecologist Steven Handel of Rutgers University began wondering if a coastal scrub habitat typical of the region could be restored on Fresh Kills. Today it seems as if his vision could turn the debris of New York's tragedy into a permanent living legacy.

Before Handel began his project to revive the area's native ecosystem, he says, "Engineers were just planting grass to prevent erosion. There was no biodiversity." Handel's team planted 700 trees and shrubs of seven species. Birds—the key to sustaining that diversity—flew from nearby forests to roost. The seeds the birds

FRESH KILLS FACTS

LOCATION The west side of New York City's Staten Island.

CONTENTS About 150 million tons of garbage (1948-2001) and wreckage from the World Trade Center site (2001-02).

AREA More than twice the size of Central Park.

HEIGHT At its highest point, taller than the Statue of Liberty.

DAILY DIET In recent years, 13,000 tons of refuse from New York City. (Fresh Kills became the city's only landfill once Edgemere landfill in Queens closed in 1991.)

WHERE NEW YORK CITY'S TRASH GOES NOW Upstate New York, New Jersey, Ohio, Pennsylvania, and Virginia.

THE NAME The "kill" in Fresh Kills comes from *kil*—"channel" in the Dutch of the area's first settlers. Fresh Kills is also the name of a nearby freshwater stream.

deposited took root, creating stands of new coastal scrub. "Now we have more than 20 plant species," he says.

It may take a decade or so, but a sea of refuse that had long stigmatized a community—and then united it in mourning—will be transformed into "a green island in an urban sea," as Handel puts it. That might be the best memorial of all.

—John L. Eliot

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■ NGS RESEARCH GRANT

Just a Salad, Thanks

An early vegetarian dinosaur surprises researchers

What are beaver-like incisors doing in the mouth of an animal that belongs to the theropods, a clan that includes meat-eating dinosaurs such as *Tyrannosaurus rex*? The *Incisivosaurus gauthieri*, a turkey-size addition to the growing list of new specimens from China's Liaoning Province, has led researchers to revise their expectations about dinosaur diets. No other known theropod has a set of chisel-shaped teeth like these, which are designed for gnawing plants.

The 128-million-year-old fossil is evidence that some early

theropods experimented with vegetarian diets and occupied ecological niches not generally associated with this group.

Though *Incisivosaurus*' prominent front teeth were a complete surprise to the team that discovered the fossil, led by Xu Xing of the Chinese Academy of Sciences in Beijing and Cheng Yennien of the National Museum of Natural Science in Taichung, there are other examples of taxonomic groups with both meat-eating and plant-eating species. Among the notoriously carnivorous crocodylians are some prehistoric

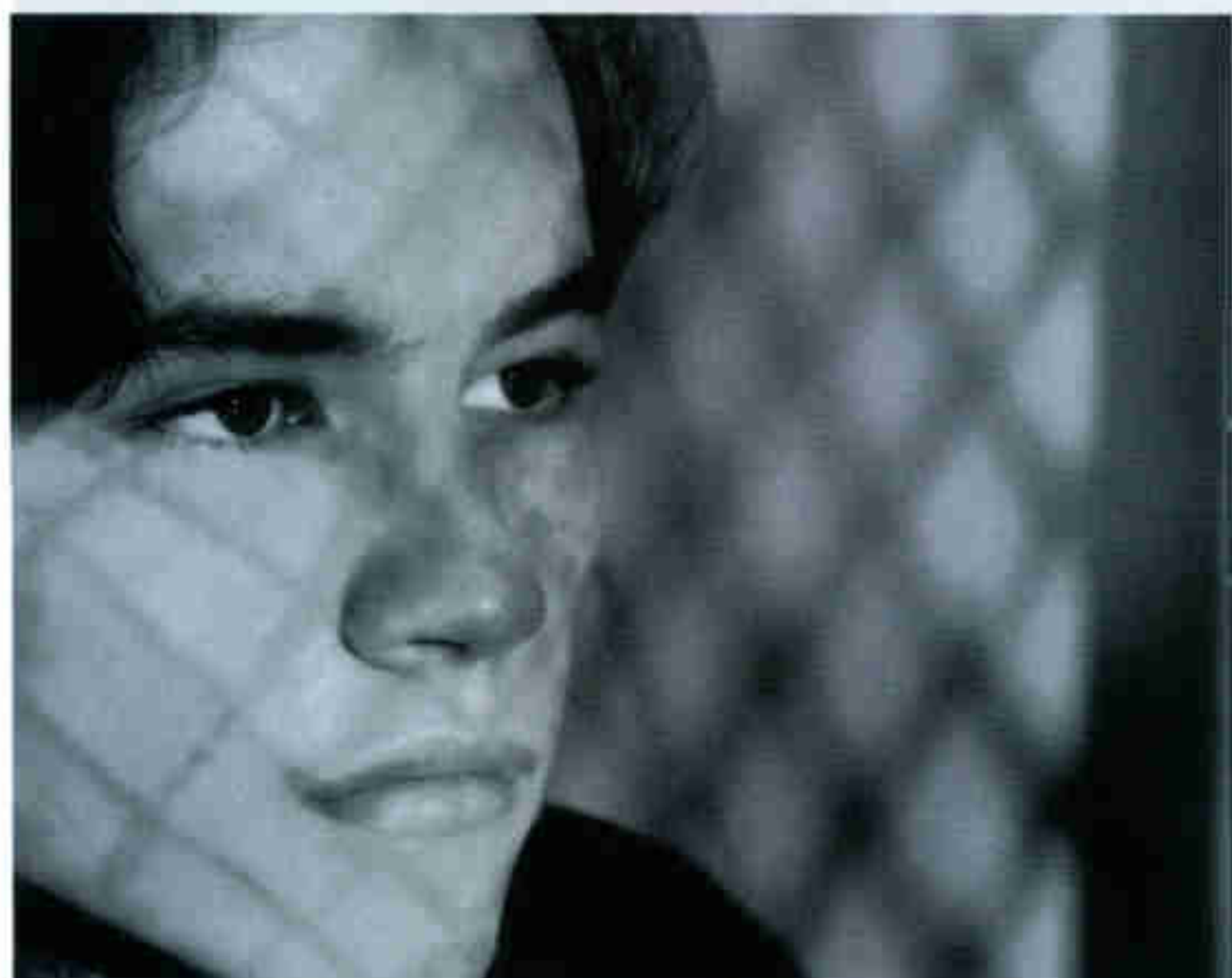
species with teeth designed for eating plants, and China's own giant panda has meat-eating ancestry, but now concentrates on bamboo.

—Christopher P. Sloan

ART BY PORTIA SLOAN



Catch speech,
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problems early, and it
can mean the difference
between a child
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When a child has a communication disorder, the feeling of isolation alone can be overwhelming. Making friends and succeeding in school can be next to impossible. More troubling, research shows that as many as 84% of incarcerated youths have problems communicating, and 70% of adult prisoners score in the lowest literacy levels. Fortunately, those same statistics show that with early identification and support, many children with communication disorders go on to develop the learning and literacy skills needed to succeed in school and in life. So be sure your child has the speech, language and hearing abilities to learn and keep up in class.



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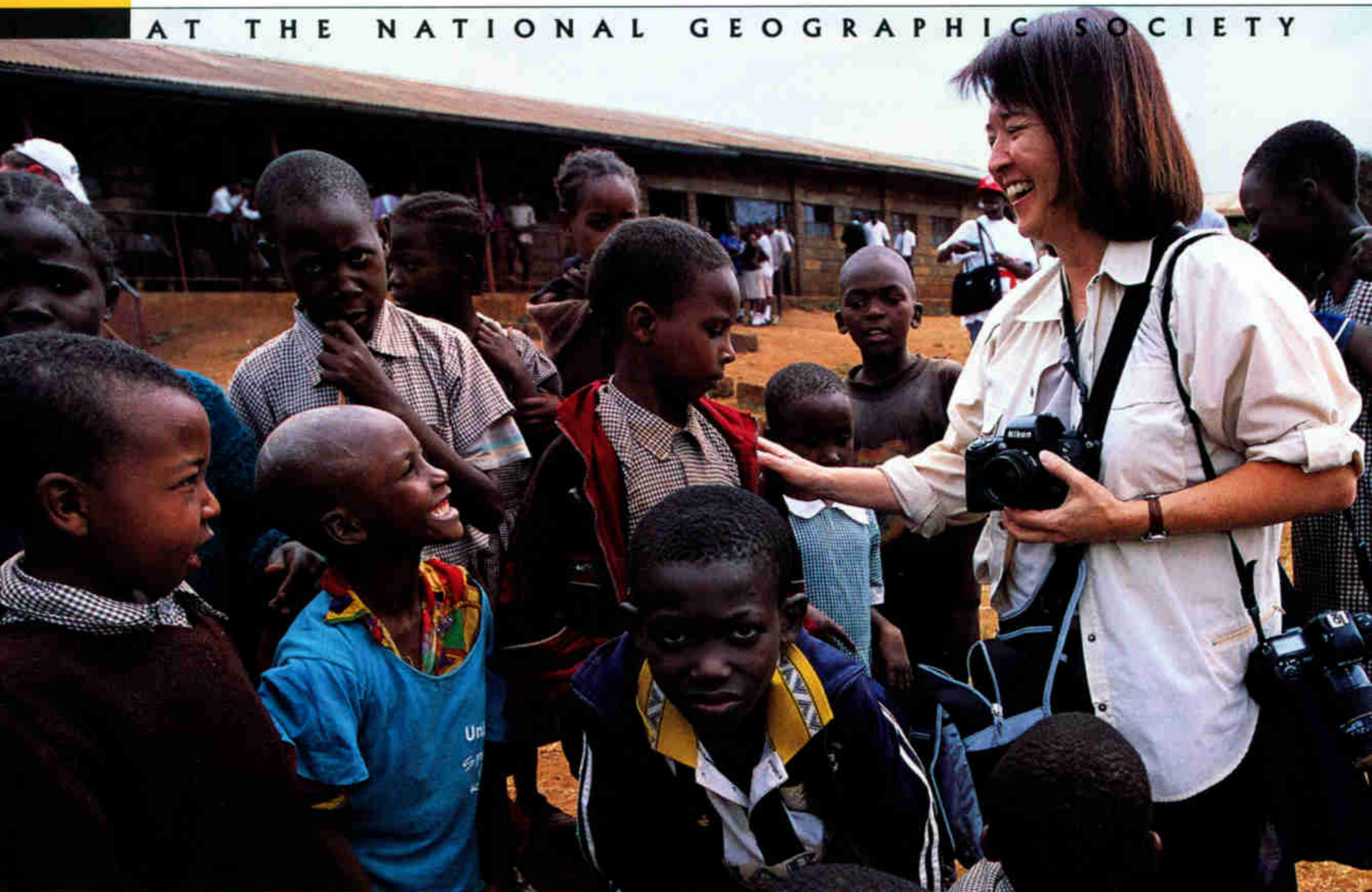
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Behind the SCENES

AT THE NATIONAL GEOGRAPHIC SOCIETY



DANIEL CIMA, AMERICAN RED CROSS

Missions Possible

Resident photographers tackle the big issues

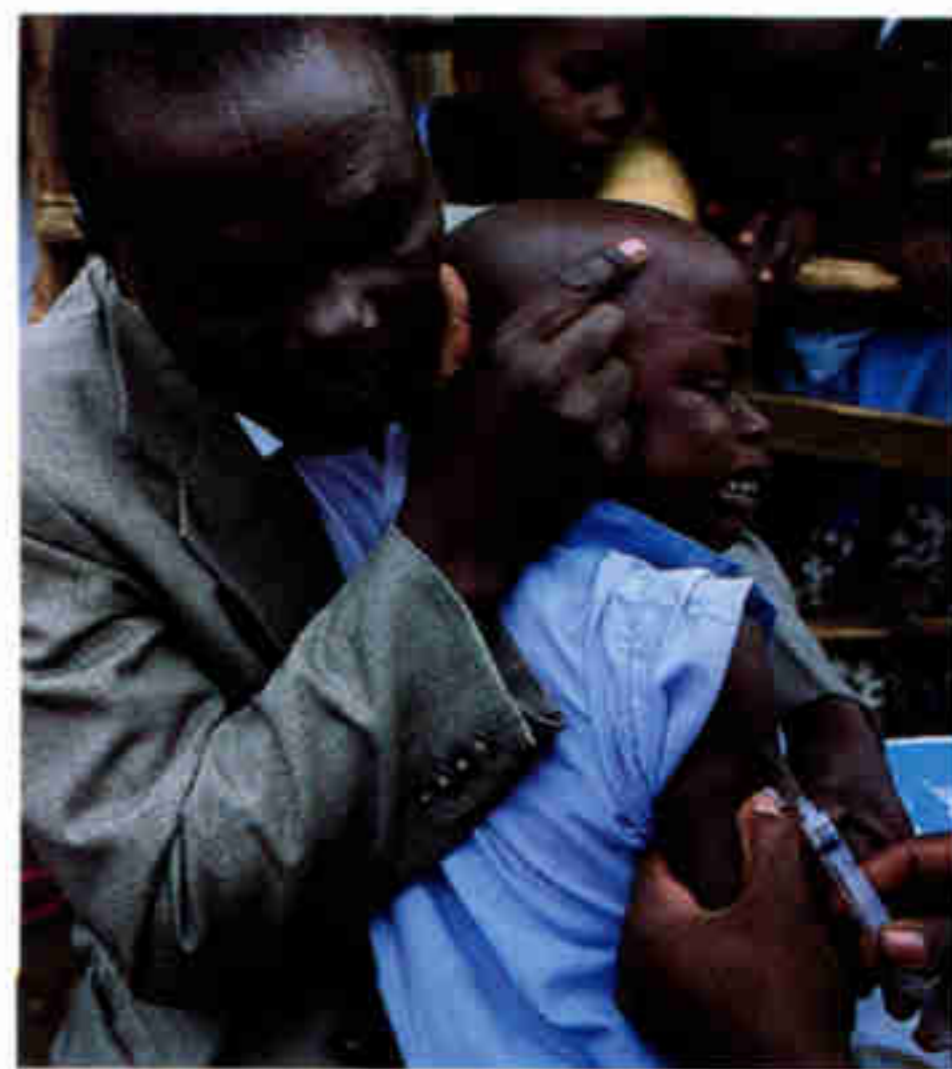
NATIONAL GEOGRAPHIC photographers fill a number of roles, says Karen Kasmauski (above). “We’re journalists, researchers, thinkers,” she says. “Photography is our tool.”

As one of the Society’s six contributing photographers-in-residence, Karen seeks to focus public attention on global changes and how they affect human health. One promising

initiative is the anti-measles campaign in Kenya (below) led by the American Red Cross, the Centers for Disease Control and Prevention, and UN agencies.

“These photographers-in-residence have chosen subjects they’ve been covering for years, subjects they’re passionate about,” says program manager Charlene Valeri. Frans Lanting investigates conservation and the dangers of habitat loss to animals in the wild. David Doubilet works to promote the survival of coral reef ecosystems in the South Pacific. Sam Abell documents North American rivers from a cultural, historical, and ecological perspective. Underwater photographer Emory Kristof will use remotely operated vehicles to take inventory of deep-ocean

species in waters off Indonesia. Annie Griffiths Belt is promoting preservation of wilderness areas in North America, both in and outside of classrooms. By speaking to audiences and displaying their work widely, the photographers hope to mobilize public support for the Society’s mission.



KAREN KASMAUSKI

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Croc Finder

Brady Barr helps capture rare species in the wild

Imagine holding a *T. rex*. That's how Society herpetologist Brady Barr (right, at left) says he felt when he held this juvenile Siamese crocodile—the first capture reported by scientists in nearly a century—in Cambodia's Cardamom Mountains last year. Surveying the mountains with the help of a Society Expeditions Council grant, biologist Jennifer Daltry, far right, of Fauna and Flora International, and Cambodian wildlife protection officer Dany Chheang, center, spotted some of the crocs in 2000. Since then Jenny has turned up more than 100 *Crocodylus siamensis*, whose numbers have shrunk due to hunting and habitat loss.



MICHAEL MASLAND, NGS STAFF

Her team sampled the critically endangered croc's DNA in search of genetic markers that might help distinguish pure and hybrid crocs in captivity. Pure crocs may be released elsewhere in the wild in a repopulation effort.

Students Tackle Real Fieldwork

To count every living species in the Great Smoky Mountains National Park, you need help. These teens (below, left), preparing for college, slogged through the park in the rain for a day with GPS units provided by the Society's

Geography Education Foundation to spot ferns and Turk's-cap lilies—part of a 15-year species census in the park. "They learned that scientists don't do stuff only in clean, dry labs," says Tennessee Geographic Alliance coordinator Kurt Butefish.



GERRY BROOME

Start the Presses!

The magazine you're holding may look the same, but it comes from a new printer: Quad/Graphics. Four of Quad's presses in Martinsburg, West Virginia—including two that weigh 627 tons each and stretch nearly as long as a football field—take on our pressrun. The presses spit out printed paper at up to 34 miles an hour, producing seven million copies of NATIONAL GEOGRAPHIC in three weeks. Shipping an issue to the U.S. and Canada takes 200 trailers.

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“Every big hug makes me glad I take care of my diabetes.”

“My granddaughter sure knows how to make my day. Her face lights up when she sees me. Then, she dishes out those hugs—and *that’s* what really makes me want to take care of my diabetes.

“I’ve got my routine down: I stay active, and try my best to eat healthier meals. To help me stay on track, my doctor added *Avandia*. It makes my body more responsive to its own natural insulin, so I can control my blood sugar more effectively.

“I started on *Avandia* over a year ago. And while not everyone gets the same results, my blood sugar has never been better. I know *Avandia* is helping me to be stronger than diabetes. That’s something I can really wrap my arms around.”

Avandia, along with diet and exercise, helps improve blood sugar control. It may be prescribed alone, with Glucophage® (metformin HCl tablets) or with sulfonylureas. When taking *Avandia* with a sulfonylurea, you may be at risk for low blood sugar. Ask your doctor whether you need to lower your sulfonylurea dosage.

Some people may experience tiredness, weight gain or swelling with *Avandia*.

Avandia in combination with insulin may increase the risk of serious heart problems. Because of this, talk to your doctor before using *Avandia* and insulin together. *Avandia* may cause fluid retention, or swelling, which could lead to or worsen heart failure, so tell your doctor if you have a history of these conditions. If you experience an unusually rapid increase in weight, swelling or shortness of breath while taking *Avandia*, talk to your doctor immediately. *Avandia* is not for everyone. If you have severe heart failure or active liver disease, *Avandia* is not recommended.

Also, blood tests to check for serious liver problems should be conducted before and during *Avandia* therapy. Tell your doctor if you have liver disease, or if you experience unexplained tiredness, stomach problems, dark urine or yellowing of the skin while taking *Avandia*.

If you are nursing, pregnant or thinking about becoming pregnant, or if you are a premenopausal woman who is not ovulating, talk to your doctor before taking *Avandia*.

See important patient information on the adjacent page.

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Patient Information about AVANDIA® (rosiglitazone maleate) 2 mg, 4 mg, and 8 mg Tablets

What is *Avandia*?

Avandia is one product in a class of prescription drugs called thiazolidinediones (thigh-a-zol-a-deen-die-owns) or TZDs. It is used to treat type 2 diabetes by helping the body use the insulin that it is already making. *Avandia* comes as pills that can be taken either once a day or twice a day to help improve blood sugar levels.

How does *Avandia* treat type 2 diabetes?

If you have type 2 diabetes, your body probably still produces insulin but it is not able to use the insulin efficiently. Insulin is needed to allow sugar to be carried from the bloodstream into many cells of the body for energy. If insulin is not being used correctly, sugar does not enter the cells very well and builds up in the blood. If not controlled, the high blood sugar level can lead to serious medical problems, including kidney damage, blindness and amputation.

Avandia helps your body use insulin by making the cells more sensitive to insulin so that the sugar can enter the cell.

How quickly will *Avandia* begin to work?

Avandia begins to reduce blood sugar levels within 2 weeks. However, since *Avandia* works to address an important underlying cause of type 2 diabetes, insulin resistance, it may take 8 to 12 weeks to see the full effect. If you do not respond adequately to your starting dose of *Avandia*, your physician may increase your daily dose to improve your blood sugar control.

How should I take *Avandia*?

Your doctor may tell you to take *Avandia* once a day or twice a day (in the morning and evening). It can be taken with or without meals. Food does not affect how *Avandia* works. To help you remember to take *Avandia*, you may want to take it at the same time every day.

What if I miss a dose?

If your doctor has prescribed *Avandia* for use once a day:

- As soon as you remember your missed dose, take one tablet anytime during the day.
- If you forget and go a whole day without taking a dose, don't try to make it up by adding another dose on the following day. Forget about the missed dose and simply follow your normal schedule.

If your doctor has prescribed *Avandia* for use twice a day:

- As soon as you remember the missed dose, take one tablet.
- Take the next dose at the normal time on the same day.
- Don't try to make up a missed dose from the day before.
- You should never take three doses on any single day in order to make up for a missed dose the day before.

Do I need to test my blood for sugar while using *Avandia*?

Yes, you should follow your doctor's instructions about your at-home testing schedule.

Does *Avandia* cure type 2 diabetes?

Currently there is no cure for diabetes. The only way to avoid the effects of the disease is to maintain good blood sugar control by following your doctor's advice for diet, exercise, weight control, and medication. *Avandia*, alone or in combination with other antidiabetic drugs (i.e., sulfonylureas or metformin), may improve these other efforts by helping your body make better use of the insulin it already produces.

Can I take *Avandia* with other medications?

Avandia has been taken safely by people using other medications, including other antidiabetic medications, birth control pills, warfarin (a blood thinner), Zantac® (ranitidine, an antiulcer product from GlaxoSmithKline), certain heart medications, and some cholesterol-lowering products. You should discuss with your doctor the most appropriate plan for you. If you are taking prescription or over-the-counter products for your diabetes or for conditions other than diabetes, be sure to tell your doctor. Sometimes a patient who is taking two antidiabetic medications each day can become irritable, lightheaded or excessively tired. Tell your doctor if this occurs; your blood sugar levels may be dropping too low, and the dose of your medication may need to be reduced.

What should I discuss with my doctor before taking *Avandia*?

Avandia in combination with insulin may increase the risk of serious heart problems. Because of this, talk to your doctor before using *Avandia* and insulin together. *Avandia* may cause fluid retention or swelling which could lead to or worsen heart failure, so tell your doctor if you have a history of these conditions. You should also talk to your doctor if you have liver problems, or if you are nursing, pregnant or thinking of becoming pregnant. If you are a premenopausal woman who is not ovulating, you should know that *Avandia* therapy may result in the resumption of ovulation, which may increase your chances of becoming pregnant. Therefore, you may need to consider birth control options.

What are the possible side effects of *Avandia*?

Avandia was generally well tolerated in clinical trials. The most common side effects reported by people taking *Avandia* were upper respiratory infection (cold-like symptoms) and headache. As with most other diabetes medications, you may experience an increase in weight. You may also experience edema (swelling) and/or anemia (tiredness). If you experience any swelling of your extremities (e.g., legs, ankles) or tiredness, notify your doctor. Talk to your doctor immediately if you experience edema, shortness of breath, an unusually rapid increase in weight, or other symptoms of heart failure.

Who should not use *Avandia*?

You should not take *Avandia* if you are in the later stages of heart failure or if you have active liver disease. The following people should also not take *Avandia*: People with type 1 diabetes, people who experienced yellowing of the skin with Rezulin® (troglitazone, Parke-Davis), people who are allergic to *Avandia* or any of its components and people with diabetic ketoacidosis.

Why are laboratory tests recommended?

Your doctor may conduct blood tests to measure your blood sugar control. Blood tests to check for serious liver problems should be conducted before starting *Avandia*, every 2 months during the first year, and periodically thereafter.

It is important that you call your doctor immediately if you experience unexplained symptoms of nausea, vomiting, stomach pain, tiredness, anorexia, dark urine, or yellowing of the skin.

How should I store *Avandia*?

Avandia should be stored at room temperature in a childproof container out of the reach of children. Store *Avandia* in its original container.



From the President



WHITE HOUSE PHOTO BY TINA HAGER. BACK, FROM LEFT: TERRY ADAMSON, EXECUTIVE VICE PRESIDENT; ALLEN CARROLL, CHIEF CARTOGRAPHER; BILL ALLEN, EDITOR IN CHIEF

All too familiar with Afghanistan, President Bush showed me a spot along the Pakistan border during last July's presentation of a map cabinet—a gift the Society has given to every President since Franklin D. Roosevelt.

A few months later I got disheartening news about the geographic literacy of young adults around the world, especially Americans. In a nine-country poll of 18-to-24-year-olds commissioned by the Society, we found that only 13 percent of Americans could locate Iraq on a map, and only 23 percent of respondents worldwide could name four countries with nuclear weapons. It's a depressing result. Given today's headlines, a poor grasp of geography can have consequences far more dire than struggling to find countries on a map. Yet we at National Geographic see this as a challenge to improve understanding of global cultures and world affairs. We're proud that another President, Nobel Peace Prize winner Jimmy Carter, told our staff three years ago that National Geographic "has done more than any other organization I can think of to tie the people of different nations together." Thanks to the support of our members, we're trying to live up to the President's kind words by convening a coalition of leaders from education, public service, and business to do nothing less than reshape the way young people think about the world. Change won't come overnight. But we have faith. Give us a generation.

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Make the most of the winter sports season before the snow melts. Consult our Adventure and Exploration guide at nationalgeographic.com/explore for expert advice on perfect-powder getaways, reviews of gear—including snowboards and all-terrain skis—and alpine photo galleries. And no matter what time of year, log on to get outdoor tips, learn survival skills, even follow expeditions online.



PAUL CHESLEY, NG IMAGE COLLECTION (ABOVE); TIM LAMAN

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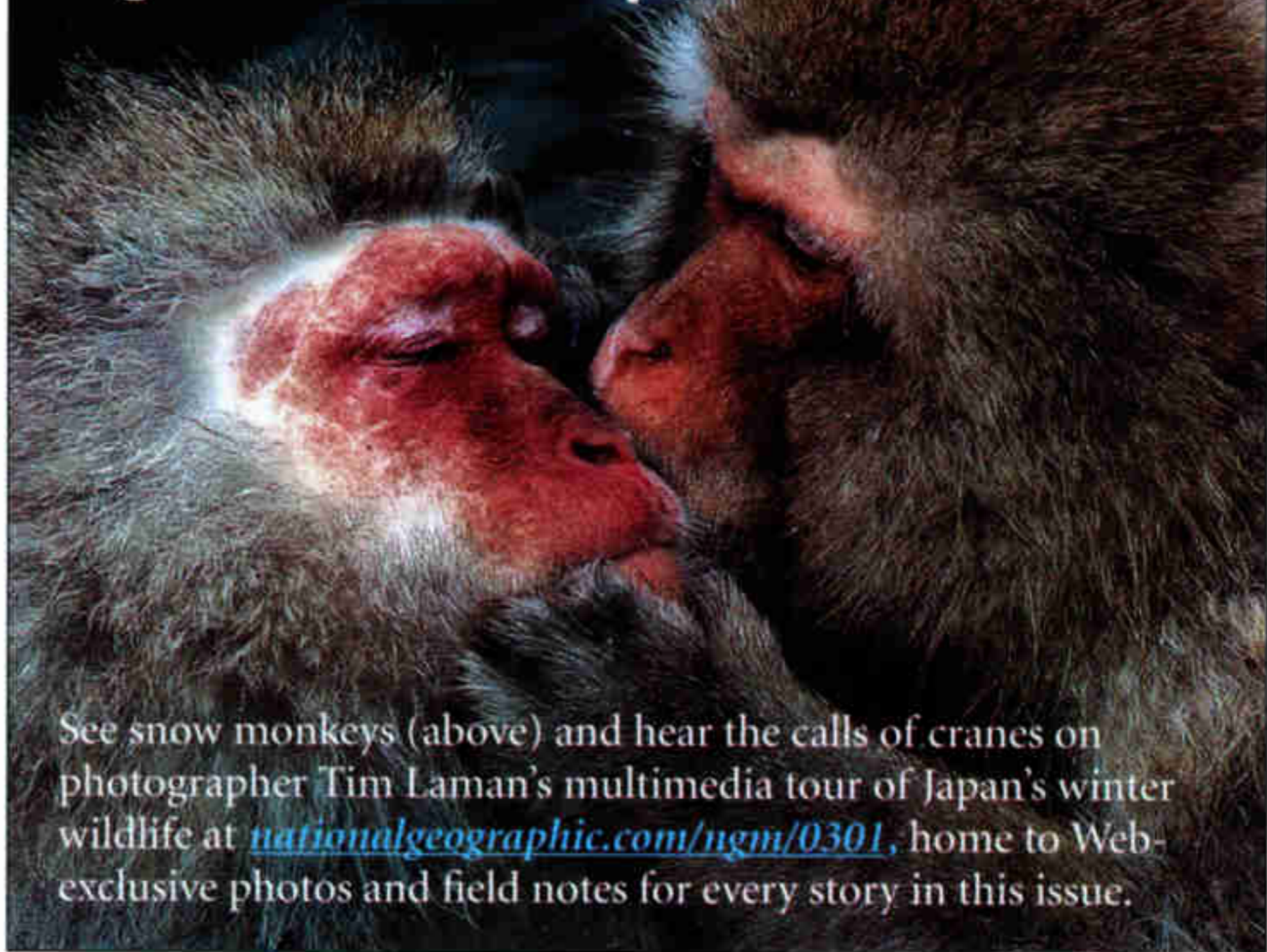
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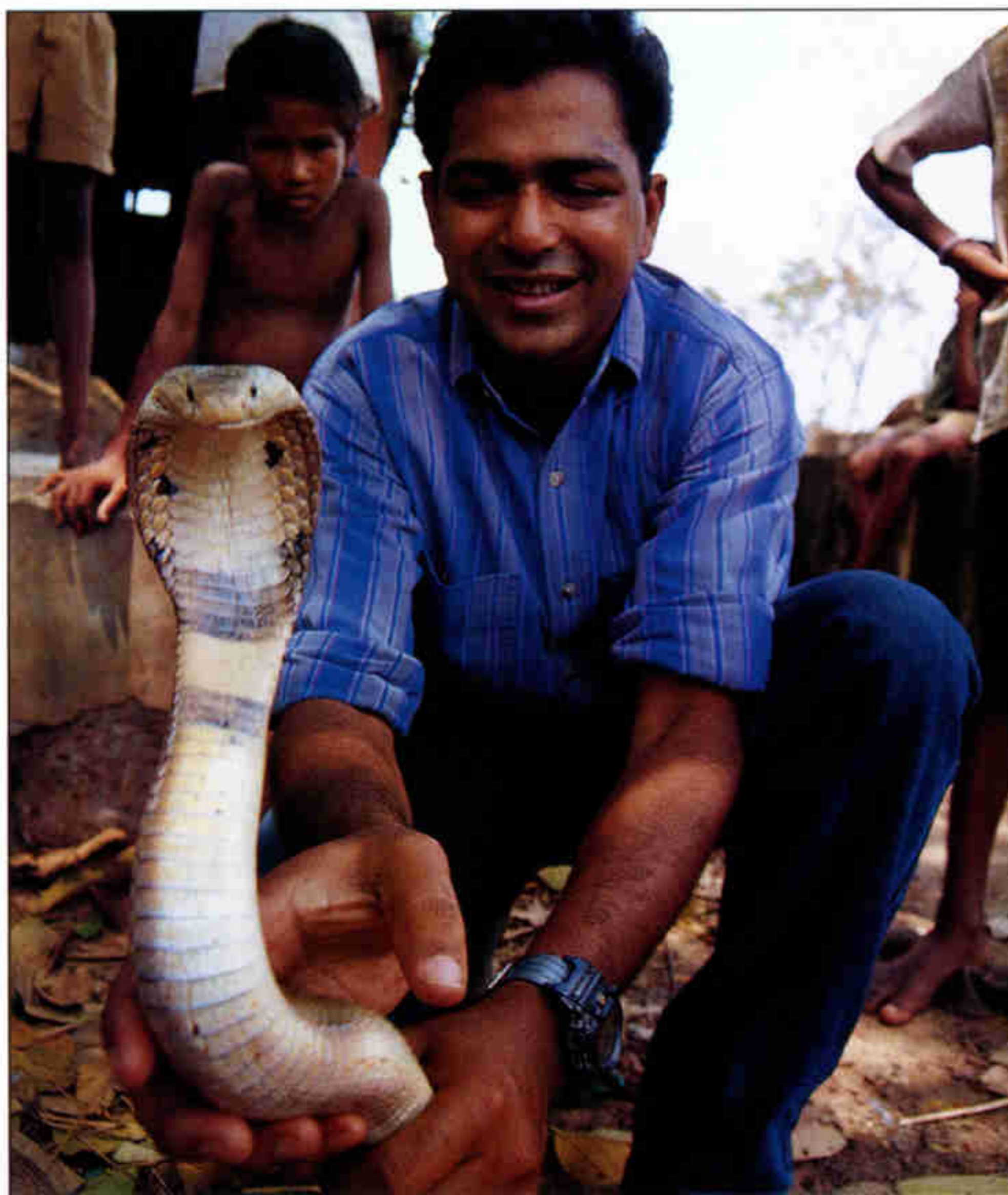
Sights & Sounds: Japan's Wild Winter



See snow monkeys (above) and hear the calls of cranes on photographer Tim Laman's multimedia tour of Japan's winter wildlife at nationalgeographic.com/ngm/0301, home to Web-exclusive photos and field notes for every story in this issue.

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Snake Wranglers

Handy with an angry cobra, herpetologist Gerry Martin (left) teaches people in rural India new ways to live with snakes. He must convince snake charmers to stop defanging cobras—a practice that eventually kills the snakes—and then train them to milk the cobras for the production of profitable anti-venom. *Snake Wranglers*, a new weekly series, follows snake experts to remote locations around the world to learn the secrets of death adders, boa constrictors, rattlers, and others—all to save an animal most people revile.

NATIONAL GEOGRAPHIC EXPLORER, MSNBC

Rule of Lions

When desperately thirsty animals—buffalos, elephants, impalas—show up at this spring during Zimbabwe's dry season, they confront the water hole's guardians, a pride of hungry lions. *Walking With Lions*, the result of four years of filming by Lynne and Phil Richardson, is an uncomfortably close look at the deadly art of ambush.



PHIL AND LYNNE RICHARDSON; RYAN LOBO (TOP)

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If You Purchased and Applied Behr Wood Sealant Products — Super Liquid Raw-Hide or Natural Seal Plus — Since January 1, 1991

Please Read this Court-Ordered Class Action Notice Carefully

There is a class action lawsuit against Behr Process Corporation and Masco Corporation that may affect your rights. The lawsuit involves Behr Products called Super Liquid Raw-Hide and Natural Seal Plus. You may be a class member if you purchased these products and applied them to an exterior wood surface within the United States since January 1, 1991.

A class action and proposed national settlement between Plaintiffs and Defendants Behr Process Corporation ("Behr") and Masco Corporation ("Masco") is pending in the Superior Court of California in and for the County of San Joaquin in the class action lawsuit entitled *Behr Wood Sealant Cases* (Judicial Council Coordination Proceeding Nos. 4132 & 4138).

What is the Lawsuit About?

Eleven class action lawsuits were filed in California against Behr and Masco generally alleging that Defendants falsely advertised and marketed the subject products as protecting the wood surfaces to which they were applied from mildew and other damage, and pleading causes of action for violations of consumer protection statutes, breach of express and implied warranties, and/or fraudulent concealment/non-disclosure. Behr and Masco deny any liability, deny that the subject products were falsely advertised and marketed, and believe that the products perform as advertised.

Similar class actions were filed in other states. All persons included in the classes alleged in those other cases are members of the Settlement Class and may participate in the settlement, opt out, or object if they so desire.

Who is Covered by the Settlement?

All persons and entities who purchased and applied to an exterior wood surface *either* Super Liquid Raw-Hide (product numbers 12, 13, 31-12, and 31-13) *or* Natural Seal Plus (product numbers 79, 80, 81, 82, 83, 84, 92, 31-79, 31-80, 31-81, 31-82, 31-83, 31-84, 31-92) within the United States since January 1, 1991.

These Behr Products were sold primarily at major home improvement centers and hardware stores. To determine whether you purchased the Behr Products, check the can label or the invoice or receipt.

What Are the Terms of the Settlement?

This Settlement will not exceed \$107.5 million, exclusive of attorneys' fees. Two types of relief are provided – Cash Payment or Merchandise Certificates.

For complete information including the Notice of Proposed Class Action Settlement, Claim Forms, procedures for excluding yourself, objecting to the Settlement and filing a claim, write: Behr Claims, PO Box 232, Minneapolis, MN 55440-0232. Or Call:

The type and amount of relief is dependent upon whether a Cash Payment or Merchandise Certificate is selected by the claimant, the square footage of the affected property, proof of purchase of the Behr Products and the extent of alleged mildew-related damage to exterior wood surfaces, among other factors.

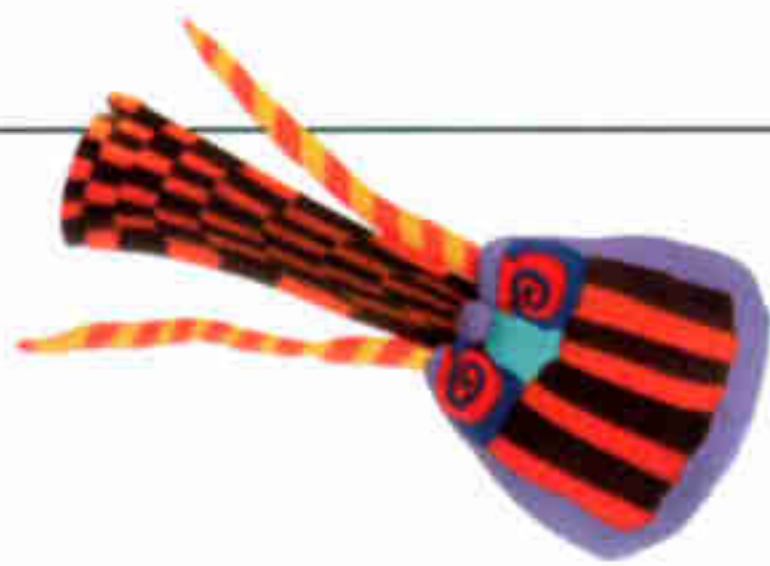
For complete information, please refer to the Notice of Proposed Class Action Settlement available by calling 1-877-637-5997 or visiting www.behrsettlement.com.

What Are My Rights?

- If you wish to remain in the Class, you need not take any action at this time. However, you will be bound by the rulings of the Court if the Settlement is approved.
- If you wish to obtain the benefits of the Settlement you must complete and file a Claim Form. Deadlines to file a Claim vary depending upon the product used, and when it was applied, as described in the Notice of Proposed Class Action Settlement.
- If you do not wish to participate in the Settlement or be bound by the Settlement terms you must exclude yourself in writing postmarked no later than **February 7, 2003** as described in the Notice of Proposed Class Action Settlement.
- If you wish to object to the Settlement, you must remain a Class Member. You and/or your counsel may appear in opposition to the Settlement following procedures for objecting which are outlined in the Notice of Proposed Class Action Settlement. Objections must be filed by **February 7, 2003**.

A Fairness Hearing will be held on **March 6, 2003** to determine whether the proposed Settlement is fair, reasonable and adequate.

1-877-637-5997 or visit www.behrsettlement.com



Who Knew?



EXO BIOLOGY

Strange Life

Would we even recognize it?

In coming years, NASA and other space agencies will intensify the search for life on Mars and elsewhere in the solar system. But the search is complicated by a fundamental mystery: What is life, anyway?

NASA has been using a fairly simple working definition: "Life is a self-sustained chemical system capable of undergoing Darwinian evolution." Brevity forbids any mention of love, friendship, or ice-cold beer.

Other scientists have circulated their own definitions, such as, "Life is a chemical system able to replicate itself through autocatalysis and to make mistakes that gradually increase the efficiency of the autocatalysis."

But of course.

Life, squirrely thing that it is, tends to elude capture by any single definition. Maybe life, for example, doesn't have to evolve. Imagine creatures that have no information-bearing molecule like DNA. They might reproduce but not replicate. The parent would be no more biologically related to the child than to a complete stranger. (Actually, I think that has happened in my own family.)

One obvious flaw with the NASA definition is that it doesn't apply to an individual organism. Let's say a space probe to Jupiter's moon Europa drilled through the surface ice and found a deep, dark ocean. And let's say that, in that ocean, the probe encountered Marlon Brando. Is he capable of reproducing? Not by himself, dare we point out. And there'd be no way of knowing if he was capable of evolving. How long would you wait to find out?

Some attributes of life may be non-negotiable. Water probably needs to be in the mix, because living things need a solvent for biochemical reactions, though ammonia might also work. And we can anticipate that life will be carbon-based, since carbon is so useful for making chemical bonds. Also, a living thing probably has to have an inside and an outside. Without a membrane, an organism can't distinguish itself from its environment. It's hard to thrive if you're just undifferentiated mush.

Philosopher Carol Cleland and astrobiologist Chris Chyba argue that trying to define life right now is like trying to define water when nobody knew that water was H₂O. They say we'll never have a good definition of life as long as we have only one example, Earth life. That's why NASA wants so badly to find a scrap of something, even the humblest microfossil, on Mars. Since we don't know precisely what life is, the search will focus on what life does. Life alters its environment. It creates "biosignatures." A really compelling biosignature would be a footprint. But it could also be just a pattern of chemicals in soil, a chemical gradient that can't be explained nonbiologically.

CHEMICAL GRADIENT FOUND ON MARS isn't the grabbiest headline, but you have to start somewhere.

—Joel Achenbach

WASHINGTON POST STAFF WRITER

IT MATTERS

They live in some of the nastiest places.

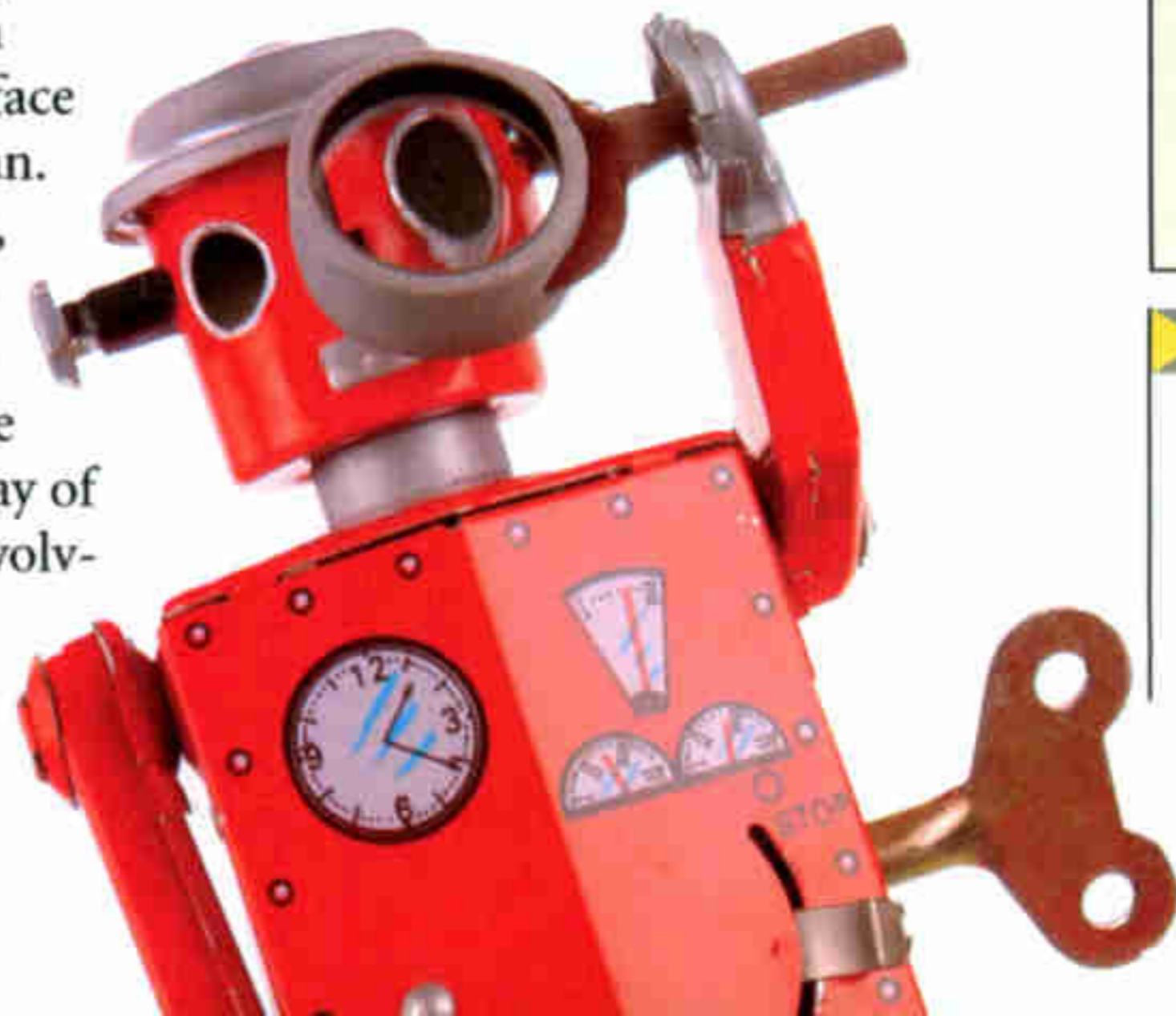
Scientists call them extremophiles—organisms that are at home in the scalding, icy, desiccated corners of the Earth. Alvinellid worms cluster around deep ocean hot springs, living in water that's 149°F. Yeasts survive in Siberian soil that's been frozen for three million years. Halobacteria thrive in brine ten times as salty as seawater. And the single-cell bacterium *Deinococcus* can shrug off radiation exposure a hundred times that required

to kill most living things. Extremophiles matter because they're probably the best models planet Earth offers for the hard-scrabble life-forms that may even now be eking out a scarcely imaginable existence somewhere in our universe. It always helps to know what you're looking for.

—Lynne Warren

WEBSITE EXCLUSIVE

Are we alone? Learn more about the search, and find links to Joel Achenbach's work at nationalgeographic.com/ngm/resources/0301.







A monumental series of walls—erected over the centuries to thwart invaders—twists through Chinese history. Today the nation welcomes visitors (and their wallets). Gleaming with new brick, an impressive stretch of wall at Juyongguan near Beijing hosts more than a million tourists a year. But preservationists claim that commercialization is marring an archaeological treasure.

CHASING
THE
WALL

HOW I DROVE
7,436 MILES
AND FOUND
THE GOOD,
THE BAD, AND
THE REAL
GREAT WALL
OF CHINA

BY PETER HESSLER

PHOTOGRAPHS BY
MICHAEL YAMASHITA





Vintage housing suits Wang Youshen and his wife, Wang Yulian. Their walled village of Laoying abuts a reach of wall built to repel Mongols during the Ming dynasty (1368-1644). Carved out of the fortifications, their home itself has 20-foot-thick walls. "Very warm in the winter, cool in the summer," says Mr. Wang.

There is always at least one happy person at a Chinese funeral. I learned this while driving across the north of China, where lessons were plentiful. I also learned to avoid driving at night, or in the rain, or on the tiny red roads that squiggled like aimless capillaries across my map. I learned that most Chinese gas station attendants

are young women, and they often give you a free pair of white cotton driving gloves with a fill-up. I learned to be wary of black Volkswagen Santanas, because in rural China they are frequently occupied by low-level Communist Party officials, who are among the most aggressive motorists anywhere in the country. There are lots of black Volkswagen Santanas in the north of China.

I was heading west. I had a rented Jeep, a tent, and a sleeping bag. I had my worries—I didn't know how the Chinese authorities would react to a foreigner taking a solo road trip, and as a precaution I planned to divide my journey into two parts, fall and spring. From my home in Beijing, I drove to Hebei Province, where I began my journey at the edge of the Bo Hai sea. I intended to follow rural roads along the path of what has come to be known as the Great Wall.

The Great Wall has become a symbol for China, and yet it has been consistently misunderstood over the past century. In the popular consciousness, the Great Wall is a unified concept, but in fact northern China is criss-

Chinese who, living near the ancient fortifications, would have their own view of the past and the present.

I began in autumn, when the Hebei harvest had been deliberately left out in the road, waiting to be threshed by passing cars. Millet, sorghum, wheat—the chaff cracked beneath my tires. The ancient walls hovered like stone mirages atop the hills. I could gauge my distance by a glance at the glove compartment. Steadily it filled with white cotton gloves as the Jeep cruised west.

I stopped for funerals all the way across Shanxi Province. The first was in the small town of Xinrong, where the main street had been blocked off by a crowd of 500. They had gathered to watch a traveling folk opera troupe perform in memory of a departed businessman named He Yu. He had owned the biggest shop in Xinrong—the Prosperous Fountainhead Store—and the opera troupe had been hired to perform directly across from the shop entrance. Even in death, He was doing good business—it was a seven-day funeral, and mourners

I HAD MY WORRIES—I DIDN'T KNOW HOW THE AUTHORITIES WOULD

crossed by many different walls built by many different dynasties. It wasn't until modern times, through a combination of foreign misconception and Chinese patriotism, that the ancient walls were symbolically linked by the use of a singular term. Many of the Great Wall's supposed characteristics—that it is continuous, that the entire structure is over 2,000 years old, that it can be seen from the moon—are false.

I was chasing a myth, and on the road I hoped to meet people who could help me untangle the truth. Scholars or specialists didn't particularly interest me—instead I hoped to meet average

wandered into the store and browsed whenever the actors took a break. The troupe's stage was a converted Beijing 130 truck, its railings removed and replaced by loudspeakers. Wei Fu, the head of the troupe, grinned beneath his greasepaint and told me that 80 percent of his business comes from funerals. "Of course I'm sorry for the family," he said, "but this is my living."

Zhang Baolong wore that same grin the following day. I was driving south and west from Xinrong, and the landscape had become barren—low dry hills punctuated by the occasional signal tower that had been part of the

Ming dynasty (1368-1644) defense system. I pulled off the road to look at one of the ancient towers, and then I heard the wails of the funeral nearby. When I approached, a pudgy man handed me his business card. It announced in Chinese: Zhang Baolong/*Feng Shui* Master/Red and White Events: Services for the Entire Length of the Dragon, From the Beginning to the End.

Twenty-seven separate services were listed on the back of the card. Some were easily defined as red, or joyful (“selecting marriage partner”), and others were clearly white (“choosing grave sites”), but occasionally the colors blurred. Zhang also handled “unusual diseases,” “house construction,” “evaluating locations for mining,” and “towing trucks.” “I’m very busy,” said Zhang. He had been hired to choose today’s burial site.

The family members took turns prostrating themselves before the tomb. Nobody seemed to mind that I was watching. First the men kowtowed, burning paper money and moaning softly. In a whisper I asked Zhang if the ancient signal tower had any influence on the tomb’s feng shui, or geomancy—the relationship with the surrounding landscape, a traditional Chinese concept that determines fortune. In the past the Communists had banned feng shui as old-fashioned superstition. But over the past 20 years, as the economy has opened up, the old belief has been revitalized—and repackaged to fit business cards.

“The position of that tower is very important,” Zhang said. “You see, this place is good because it’s high, and there’s water in that stream to the east. And you have the signal tower above, which serves to protect the tomb.” Then he

The keening rose another pitch. I wondered if this conversation might be more appropriate at another time, but Zhang kept talking. As far as he was concerned, he had already guided this particular dragon to its end.

“I have three sons and three daughters,” he said. “My sons are feng shui masters! And one of my daughters”—he beamed at the thought of security, in this world and the next—“is a nurse!”

THE FUNERALS gave way to ancient forts as I continued toward the autonomous region of Inner Mongolia. Today Inner Mongolia lies within China’s territory, but in ancient times this was a border region whose rule was often uncertain. As a result the northern Shanxi landscape is studded with ruined defensive works that are made of tamped earth—hard-packed yellow soil that has faded in the sun. I passed signal towers and walls that stretched for dozens of miles and villages that were entirely contained by high-walled forts. Many of the town names included the characters for “fort,” “barracks,” and “checkpoint.” Once, these had been garrisons for Chinese soldiers; now they were sleepy villages. The peasants here grew potatoes. They worked steadily under a sunny sky, and the forts seemed out of place, like an ancient fear turned to dirt and left to crumble.

The majority of these defenses dated to the Ming dynasty—the builder of the greatest walls in Chinese history. Most of what we now think of as the Great Wall was built during the Ming, which was the only dynasty to construct long sections in brick and stone. Here in Shanxi, where they had defended against the Mongols,

REACT TO A FOREIGNER TAKING A SOLO ROAD TRIP.

slipped into official feng shui jargon, jotting the words into my notebook: “A person buried in this location will have many wealthy descendants, who will rise to high civil, military, and scholarly positions.”

Now the women kowtowed, their wails echoing across the valley.

“My father and grandfather were both feng shui masters,” Zhang said. “We’ve always done this in my family. And everybody in my family lives for a long time. My father lived to be 95, and my mother was 88 when she died. My grandfather lived to be 99!”

some of the Ming fortifications had been four-fold—quadruple lines of parallel walls.

But long before the Ming and the Mongols there had been other fortifications, other threats. Traditionally, the Chinese classics had taught that eventually all peoples will succumb to the appeal of culture and become civilized. But theory and practice parted company along the northern frontier, where early states often defended against the Hu. The Hu’s origin is mysterious; they are thought to have included horse-riding nomadic peoples from Central Asia who were linked by a key characteristic: They



REMAKING WALLS—AND LIVES

Lofty plans take shape along the Yalu River as workers rebuild a 1.3-mile section of wall (left). Beyond the river lies North Korea, source of today's trespassers: those hoping to escape a despotic regime and reach South Korea by seeking asylum in foreign embassies. Descendants of earlier arrivals, Kazakhs in Gansu Province recite Muslim prayers before feasting on lamb and horse at a memorial service (below). Many of the nomadic Kazakhs now live in apartments but use traditional yurts for ceremonies.

showed no interest in assimilating Chinese culture. The name first appeared during the Warring States period (403-221 B.C.), when the nomads initially came south and wall building accelerated, as it did again during the Qin dynasty (221-207 B.C.), the first to unite the empire. The Hu were viciously effective warriors, and their appearance in this part of the world was as sudden and anomalous as these ancient forts seem to a modern motorist who happens to be driving north.

I stopped in Ninglu, the last village in Shanxi before the Inner Mongolian border. The population was 120, and the settlement was surrounded by an ancient garrison wall nearly a mile in circumference. Old people sat in the village square, soaking up the sun.

In Chinese villages I often asked if there was anybody who understood local history, and sometimes the people pointed me to a local sage or an amateur historian. Sources of Chinese history can be humble; official archaeologists and historians are so overworked and underfunded that they often don't have much time for a place like Ninglu. Whenever I spoke to scholars, they emphasized the same thing: Don't underestimate the value of local memory.

The old people in the square answered my question immediately. "Talk to Old Chen," they said.

His name was Chen Zhen, and he was 53 years old. He was a potato farmer—he worked less than two acres of dusty farmland—and he owned five sheep. His annual income was



around 200 dollars. He wore heavy black-rimmed glasses, and his silver hair was cropped close to his head. He took me to his home, where he opened a drawer and pulled out a sheaf of rice paper that had been stapled together. On the front cover he had written: The Annals of Ninglu/Research Established January 22, 1992.

I opened the book and read Chen's careful script: "The town wall was built in the 22nd year of the Jiajing Emperor (in 1543), and encased in kiln-fired brick in the first year of the Wanli Emperor (in 1573)."

There were dozens of pages, hundreds of dates. There were sketches and maps. I leafed through the book, wishing there was a photocopy machine within three hours' drive. "I researched the county archives," Old Chen explained, "and then I talked to old people in

town who remembered things. Some of them have died since I started. I just finished last year."

He showed me some pottery fragments that he had found near a Han dynasty wall. Three different dynasties had left fortifications in this region, and Old Chen offered to take me out to the ruins. We drove north into the mountains, where he led me into a high valley of scrub grass and dusty gullies. Old Chen had the slow, deliberate walk of the Chinese peasant: hands clasped behind his back, head bowed thoughtfully.

He pointed out the Northern Wei dynasty (A.D. 386-534) wall, a faint two-foot-high ridge running northeast. The Han dynasty (206 B.C.-A.D. 220) wall was so small that I wouldn't have noticed it without his help. Running parallel to it was the Ming wall, six feet high and marching eastward across the

(Continued on page 16)





RAMPARTS FOR

WRITHING LIKE DRAGON TAILS, THE GREAT WALL IS NOT ONE STRUCTURE BUT MANY.

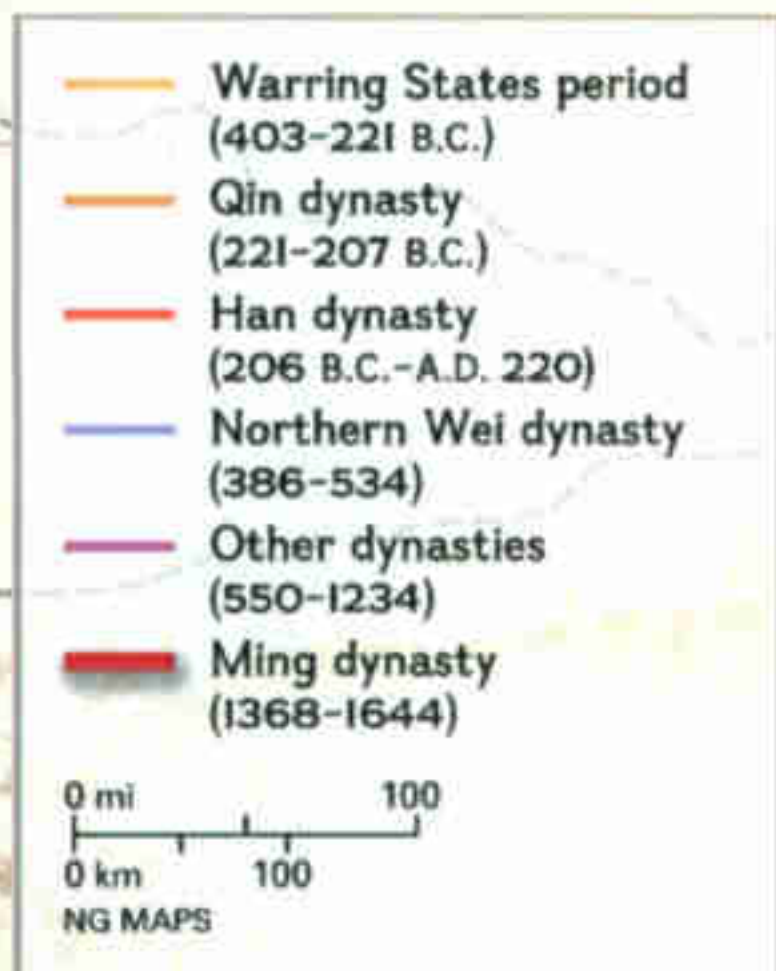
Some border walls are said to date from the seventh century B.C., but most of what we call the Great Wall was built during the Ming dynasty. Its effectiveness was spotty: Some invaders merely made end runs. But wall-top paths did help Chinese defenders move soldiers and equipment.

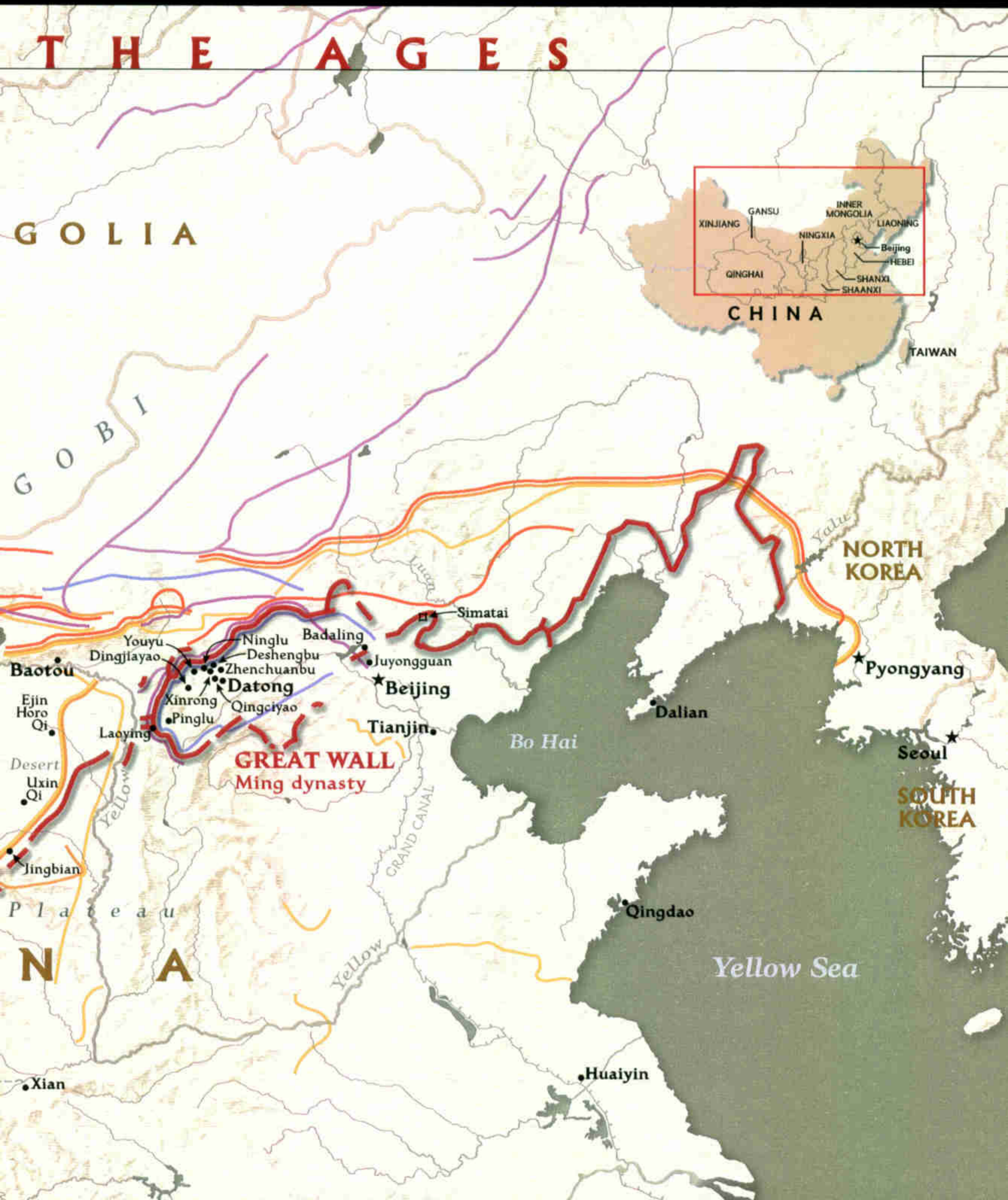
A fence protects a section of Han dynasty wall near

the Jade Gate Pass to the Silk Road (above left). Using historically authentic methods, workers tamp earth at Jiayuguan to rebuild a stretch of Ming wall (second from left). Near Tianjin, workers fire bricks for wall construction (third from left). The precipitous stone-and-brick Simatai section of the wall (far right) includes such whimsically

named sections as the Fairy Tower and Heavenly Ladder. The total length of the walls is unknown, though the sections built by the Ming alone would stretch from Washington, D.C., to Wichita, Kansas (inset).

Ulan Bator
★
M O N







Sheep exit a hole punched through a weathered span of wall in the Gansu Province village.

**WESTERN WRITERS DECLARED, WITH
ABSOLUTELY NO EVIDENCE, THAT THE GREAT WALL
COULD BE SEEN FROM THE MOON.**

of Xiakou. In many places the wall's bricks and stones are cannibalized for building material.



THE FAR REACHES

A red tide of peppers floods the sere plain of Ningxia, where the wall scales mountains beyond. Wu Zhanmin hauls his “sheep horn” peppers from Inner Mongolia. “They take a month to dry—even more if it rains.”

At the Ming wall’s western end near Jiayuguan (left), sightseers perch atop a defensive tower. Such attention is relatively new; after construction ended in the 1600s, the wall was largely neglected. Only in the 20th century did the Great Wall become a symbol of national pride.

hills. It was intersected by the road, where a stone tablet, stuck into the heart of the wall, proclaimed Inner Mongolia. The Ming wall still serves a political purpose, marking the border between Shanxi and Inner Mongolia. It also represents an economic divide—because parts of Shanxi have lower land-use fees, peasants in this area told me they prefer to farm the southern side of the wall.

Back at his home, Old Chen pulled out a map and said that the village was originally called Ningxi Hulu. The name translates as: Pacify the Hu.

“Basically it means kill the foreigners,” he said with a smile. “Look at this—” He pointed to another village on the map, ten miles to the east: Weilu. Overawe the Hu. Fifteen miles to the west: Pohubu. Destroy the Hu. Another 20 miles beyond that: Shahukou. Slaughter the Hu. Today these villages use the character for “hu” that means “tiger”—a change made during the Qing dynasty, whose Manchu rulers came from northern tribes and were sensitive to the portrayal of people from beyond the border walls.

Old Chen shook my hand when I left. “Next time you come,” he said, “try to bring an archaeologist.”

I DROVE into Inner Mongolia. These were high, empty steppes, and at twilight I pulled off the road to camp. The night was cold and clear, with massive stars overhead, and the Big Dipper hung heavy in the western sky. I fell asleep thinking about the border towns whose



names bristled along these mountains: Pacify the Hu, Destroy the Hu, Slaughter the Hu. At midnight the tent was suddenly bathed in light and I sat bolt upright, thinking that it was the headlights of a truck. Then I realized that the moon had just broken the horizon. I sat still for a moment, listening to the wind and the pounding of my heart.

My trip had not been officially approved, and occasionally I passed through areas that were not open to foreigners. I tried to move quickly when I was in sensitive regions, and I often camped or stayed at truck stops, to avoid registering at a hotel. For this fall trip, I hoped to make it to Shaanxi Province, and then in the spring I would continue to the far western end of the border walls.

People in these areas rarely saw foreigners,

and sometimes they asked if I was Mongolian, Tibetan, or Uygur—a Hu, more or less. I often picked up hitchhikers; usually they were going back and forth between rural hometowns and new urban settlements. China's migrant population is estimated to be 150 million, mostly peasants who are searching for work in the cities. Many of my riders were small-town sophisticates—former peasant women who had made the leap to the city and now worked as waitresses or beauty parlor attendants. Their hair was dyed unsubtle shades of red and they entered the car in a cloud of cheap perfume. They sat stiffly, their backs hardly touching the seat, as if riding in a car was a formal experience. Typically they waited ten minutes before asking, politely, "You're not Chinese, are you?"

One morning in rural Inner Mongolia I





Blazing in costumes as loud as their drums, celebrators in Laozhuang mark Spring Festival with showy

I PASSED SIGNAL TOWERS AND WALLS
THAT STRETCHED FOR DOZENS OF MILES AND VILLAGES
ENTIRELY CONTAINED BY HIGH-WALLED FORTS.



ritual. Village elders lead marchers through area towns for ten days during the observance.

picked up a young woman and her grandfather. They were both migrants—they shared an apartment in Jingbian, a small city 80 miles away. She was named Wang Yan; the given name means “swallow.” She had elegant, small-boned features and almond-shaped eyes the color of coal. A tiny beauty mark had been tattooed upon her forehead. She wore a red silk dress. Her appearance in this barren landscape surprised me as much as if a bird had come and settled in my Jeep.

Her grandfather was slightly deaf. He carried two enormous bags of salt, harvested from the family farm in Inner Mongolia. It occurred to me that the family had probably sent him to live with the young woman so she wouldn't get in trouble in the city.

The moment he entered the car, the old man asked: “Do you know Han Heliu?”

I shook my head, confused by the question.

“He's from our village!” the old man shouted. “He's gone to Beijing to work! I was wondering if you've met him yet!”

I told him I'd keep an eye out. Swallow smiled and shook her head.

The old man shouted questions at me while I drove. He asked what Beijing was like, and whether I was Chinese. He asked how much I planned to charge them for the ride. Swallow stared straight ahead and hardly spoke. But one of the few things she said was, “All of the young people leave our village. I'm not going back.”

MY FALL JOURNEY ENDED in the Loess Plateau of central northwest China. The plateau covers 300,000 square miles, and in appearance it is one

to tear through the fragile land, taking the topsoil with it. Over time, tiny creeks create immense canyons. People live in caves that pockmark the crumbling hillsides.

I always noticed the propaganda more in these empty landscapes. Whenever natural features like trees and ground cover disappear in China, words take their place, often carved straight into the earth. Sometimes their prescriptions were obviously impossible; I drove past brown barren hillsides that had been tattooed with 50-foot-high words: “Make the Green Mountain Even Greener.” But there was something mesmerizing about driving past a mountain that said “Marry Late and Have Children Late.”

In Shanxi Province's Youyu County, I passed a section of the border wall where four massive towers had been converted into propaganda. Each structure had been whitewashed with a single 40-foot-high character. Together they read: “Protect Water Solidify Earth.”

I realized that the words and the walls were a perfect match. Chinese walls also have a tendency to fill empty landscapes, and, like the slogans, the defense structures' inspiration had usually been more philosophical than practical. Over the course of Chinese history there was often an inverse relationship between pragmatism and wall building. The Tang dynasty (A.D. 618-907), one of the most powerful in Chinese history, never built long walls. The Tang ruling family had some Turkic blood, and they were skilled at interacting with Central Asian tribes through a combination of war and diplomacy. But centuries later the Ming refused to adopt either of the two time-trusted methods of

WHAT DOES IT MEAN WHEN SMOKE SIGNALS ARE REPLACED BY CELL

of the least hospitable landscapes in China—dry yellow mountains, craggy gullies. Centuries ago these hills were forested, but generations of farmers and years of drought have left the land as bare as a beach. Because the region represents the last northern stretch of arable soil in a crowded country, it's still heavily farmed; since 1949 the population of the Loess Plateau has more than doubled. Farmers rely on extensive terracing to coax crops from the earth, which is rock-hard when dry but falls apart when wet. Rainfall is rare—around ten inches annually—but even this small amount of water is enough

dealing with nomads: the Ming were too weak to drive out their neighbors, and too proud to offer trade or subsidies to people they considered barbarians. Instead of choosing one approach, the court bickered for decades, finally building walls out of a failure to commit to either war or peace. The Jiajing Emperor, frustrated by Mongol raids during his rule from 1522 to 1567, decreed that the character for barbarian, *yi*, should be written as small as possible on official documents. The Ming fortifications were born of the same impulse: more a message than a tactic. They scrolled across the northern emptiness, telling a

long tale of human stubbornness and indecision.

The four towers—Protect Water Solidify Earth—led up to an ancient garrison fort. The tamped-earth structure stood at the summit of a massive mountain, overlooking a half-dozen valleys where the loess soil had been carved into a riot of stunningly intricate patterns. Terraced fields descended hillsides like curling staircases. In some places there were galaxies of tiny squares, each of them two feet across and a few inches deep, designed to contain and protect thousands of saplings that had yet to be planted. The fort's wall had been whitewashed with another message: Use the World Bank's Opportunity Wisely/Help the Mountainous Area Escape from Poverty.

I drove to the Youyu County water bureau, where an official accompanied me on a tour of the area. Along with other parts of the Loess Plateau, this region was home to one of the World Bank's most widely praised Chinese projects. The official told me how the development organization's loans were being used to encourage the planting of trees, solidify terraces, and prevent erosion. He introduced me to Han Jixiang, the Communist Party secretary of Xiaojiang, a village of 400. "In the past, whenever it rained, everything washed away," Han told me. "The roads just disappeared. It's so much better now." His comments echoed what I had heard in the past from other visitors to the Loess Plateau—in this difficult landscape, the World Bank has had success battling poverty and deforestation.

I drove away, dazzled by the reformed loess landscape. Signs of work were everywhere along the road, and I stopped again to look at the fort's

people have been digging holes and you still don't see any trees here. Why not? Because our labor is free, but they'd have to pay for the trees. The local officials embezzle the money instead."

The other peasants told me that in recent years the population of their home village, Dingjiayao, had dropped from 200 to 80. They said that much of their topsoil had been removed and carted to roadside plantings, which were important for inspections. These saplingless squares served the same purpose—despite the World Bank's success elsewhere in the north, this particular village was creating a Potemkin hillside.

"We see the World Bank officials in their cars when they have inspections, but we can't talk to them," the young peasant said. "The county leaders don't let us. Actually, I don't even know what 'World Bank' means. All I know is that it has something to do with investment. They just tell us slogans: Protect the Land, Turn the Land into Forest."

He asked me not to use his name, but he wanted the name of his village published—like many people in rural China, he still had faith that higher levels of the government would rectify local wrongs. While we were talking, a tiny tractor pattered up the hill. The driver handed each of the workers five packages of instant noodles—their pay for the day's digging. The peasants ate the noodles dry, because the only water on this hillside was the word painted on the ancient tower. I noticed that the packages said "Islamic Beef Noodles."

"Are you Islamic?" I asked.

"No," grinned the peasant. "But these are the cheapest brand—no pork. A nickel each!"

PHONES, BUT YOU STILL HAVE TO CLIMB THE WALL TO USE THEM?

propaganda. That dazzled me as well—this structure, once built to keep foreigners out, was now touting the benefits of international aid.

Near the tower that said "Water," I passed a work crew of ten peasants. They were using shovels to carve squares into the hillside—tiny dirt forts for future saplings. I asked the peasants what they thought about the project.

"They've been doing this kind of thing since I was young," a 28-year-old man said. "In the past it wasn't the World Bank, but there have been other campaigns. You see all of these holes? They're empty. For two or three generations

IN SPRING I set out to finish the journey. This time I hoped to reach Gansu Province, home to the westernmost ruins of Han and Ming dynasty forts. Again I started in Beijing, but this time I followed a northern route, intending to pass quickly through Inner Mongolia. On the map it looked simple—but I never imagined that it was possible for a traffic jam to materialize on the barren steppes of Inner Mongolia.

A sudden storm had blown south from Siberia, and the temperature plummeted. Fuel lines froze solid—enormous blue Liberation trucks stopped dead in their tracks on Highway 110.

Most of the other vehicles on the two-lane road were black Volkswagen Santanas. They had been better designed for the cold, but black Volkswagen Santanas have a psychological weakness: impatience. They wouldn't wait for the truckers to maneuver their vehicles off the road; each Santana kept nudging ahead as far as possible, pinning the car in front, getting pinned in turn from behind, until at last the highway was gridlocked for a mile. Meanwhile the truckers clambered down beneath their rigs, where they ignited flares and held them hopefully against the frozen fuel lines. Nearby, a highway safety sign proclaimed: This Road Has Had 65 Crashes and 31 Fatalities.

I arrived just as the tableau was complete: the snow-swept steppe, the frozen vehicles, the flares glowing in the distance like joss sticks. Or fuses.

The scene wavered between the dangerous

and the surreal—a common condition for Chinese motorists. Once, near a Ming wall outside of Beijing, I met an 82-year-old woman with bound feet who had never made the two-hour trip to the capital. “I get car sick,” she said, when I asked why she had never traveled, and over time I came to appreciate her simple wisdom. During my journeys, the vehicle got stuck repeatedly in snow, sand, and mud. Car sick. Locals yanked me out and gave directions. Roads were mixed—occasionally there was a perfect stretch of new asphalt, but often it only lasted for a few miles before fading into potholes. Everything seemed to be half-built. Maps were unreliable. A couple of times I drove on roads that deteriorated into dried creekbeds. Another time I passed an automobile, smashed almost beyond recognition, that was suspended on stilts



Veiled in red—China's most auspicious color—newlywed Zhu Birong is spirited from her home by her groom, Liu Yongchun, to his family's house following their marriage in the walled village of Deshengbu.

More in celebration than sorrow, a funeral at the Qingciyao coal mine honors the passing of an 80-year-old woman. Following a common practice at funerals, players in an itinerant folk opera troupe dance, sing arias, and perform comedy skits on the back of their truck.



rites of passage



fifteen feet above the road. It promoted highway safety; on the door somebody had painted: "Four People Died Inside." Car sick. Outside of Baotou, a city in Inner Mongolia, I paused to marvel at the wreckage of an enormous truck that had somehow wedged itself sideways into a tollbooth, like a Chinese puzzle: a carved pagoda within a jade egg.

The crumbling walls were never far away, a companion piece to the halfway stage of China's rush to progress. In Ningxia Autonomous Region I passed through Xingwuying, a desert village whose residents only received good cell phone coverage if they climbed the local Ming dynasty fort. They stood atop the faded ramparts, dialing furiously, gazing into the distance as if searching for invaders. In these regions the motorcyclists fixed compact discs to their mud flaps as makeshift reflectors. High-tech intersected with the ancient, as if modernity had arrived with the suddenness of an invasion—what does it mean when smoke signals are replaced by cell phones, but you still have to climb the wall to use them? In Xingwuying, the ancient wall was now an accessory: attached to cell phones, it fortified reception.

The country swept past. There was movement everywhere, but the symphony of migration also had antiphonal strains of settling down. The descendants of the Hu were coming to rest. In Uxin Qi, a small Inner Mongolian town just on the outside of the Ming border wall, the ethnic Mongols had shifted to a settled life of farming and herding. Government programs had



A fog of coal dust hangs thick in the mining town of Zhenchuanbu, one of many backwaters in Shanxi

**THE CRUMBLING WALLS WERE NEVER FAR AWAY,
A COMPANION PIECE TO THE HALFWAY STAGE
OF CHINA'S RUSH TO PROGRESS.**



Province that are emptying as residents—especially the young—leave for opportunities in larger cities.

planted willow trees across the Mu Us Desert; the leaves could be harvested in autumn and fed to the sheep. Locals called it “the pasture in the sky.” I visited Mongols who had grown up in felt tents; now they had brick homes, televisions, and video compact disc players. They told me life was better than ever before. On their mantels the peasants erected small shrines to both Mao Zedong and Genghis Khan.

But when I stopped at the Genghis Khan Mausoleum, 70 miles away near Ejin Horo Qi, a young tourist pulled me aside and said that there are still more Mongols in China than in independent Mongolia. “We’re a fallen race,” she said. “We don’t have a united country, and yet at one time we were the greatest race in the world. Have you noticed that Mongols drink a lot?”

Certainly I had noticed that her breath sang of grain alcohol. And I had noticed that virtually everybody else at the Genghis Khan Mausoleum seemed to be drinking as well. Guides, tourists, ticket-takers—all of them staggered under a bright blue sky. Some of the more sober mausoleum employees told me bluntly that Genghis Khan’s remains weren’t really here. Most historians say he was buried. The Chinese claim that his tomb is in Xinjiang; Mongolians claim that it’s north of Ulan Bator. The controversy has raged for years, and yet the only tangible

monument is the mausoleum outside Ejin Horo Qi—nothing more than a symbol and a tourist destination. The young woman asked me where I was from, and then she smiled wistfully. “The Great America,” she said. “It’s like Genghis Khan used to be.”

AFTER INNER MONGOLIA I crossed the Tengger Desert—an emptiness of graceful dunes and golden sand. I followed the Yellow River westward into Gansu Province and then turned north. In ancient times, Gansu had been the western hinterland, and the old fortifications were heavy here. Miles of earth wall ran alongside Highway 312.

At Jiayuguan I met Yang Yongfu, who was rebuilding part of a Ming dynasty wall. It wasn’t the first time I’d seen old-style walls under construction—along the North Korean border in Liaoning Province, I once visited a site where the local government was erecting a massive 1.3-mile-long stretch of brick and stone.

There is something appropriate about the fact that even today the Chinese are still building—and finding—the Great Wall. Its significance has never stopped developing—in a sense, it has come a long way since the Ming dynasty collapsed in 1644. The next dynasty, the Qing, viewed the walls as a reflection of the Ming’s failure to defend borders through diplomacy and military power, and the fortifications were left to deteriorate.

But starting in the 1600s,



NEW WALLS FOR THE PEOPLE

Recent massive projects serve commerce, not defense. Apartment blocks in Pinglu stand ready for an influx of migrants seeking work in the mines of Shanxi Province, site of rich coal deposits. In Inner Mongolia, an autonomous region of China, coal powers the steel mills of Baotou (right), a city of more than two million residents, 170,000 of whom work in steel production. Among the area’s largest cities, Baotou was a fur-trading center in the 19th century during the Qing dynasty.





HITTING THE WALL

Runners in the Great Wall Marathon confront China's version of the Boston Marathon's Heartbreak Hill 80 miles northeast of Beijing. "No one ran up those steps," says photographer Mike Yamashita. "They walked." The runners he met called it the toughest stretch they'd ever encountered anywhere.

Less arduous pursuits can be found at Badaling Safari Park. For amusement, customers pay \$3.60 to toss a live chicken to hungry lions. For a sheep the price jumps to \$36.

Europeans who visited China began to return home with exaggerated reports about the walls. Many falsely believed that all sections dated to a single period, giving rise to a popular misconception that the entire structure was built during the Qin dynasty. Travelers saw the impressive Ming fortifications near Beijing and assumed that they continued in brick and stone all the way across China, when in fact most of the structures had been built of tamped earth. In the first decade of the 20th century, Western writers declared, with absolutely no evidence, that the Great Wall could be seen from the moon. The length was often exaggerated. While experts say that the Ming fortifications are roughly 1,700 miles long, there is no accurate figure for the length of China's border walls, because so many parts haven't been surveyed.

Even the term Great Wall—used to describe a structure with almost mythic characteristics—was originally a foreign phrase. The old Chinese wording *changcheng* was understood simply to mean a "long wall," and the great Ming walls were called *bianqiang*—border walls. But by the early 20th century some Chinese started using the phrase *Wanli Changcheng* (literally "10,000 *li* long wall") to render the Western concept of a Great Wall of China.

Leading Chinese scholars criticized this trend as historically inaccurate. "Chinese geographers lamented the loss of the original concept," said Arthur Waldron, a historian at the University of Pennsylvania. "They used it as an example of



how terminology can become profoundly misleading and misunderstood.”

But Chinese nationalists realized the symbolic value of a unified Great Wall. Both Sun Yat-sen and Mao Zedong used the Wall to represent the nation, and in 1984 Deng Xiaoping commanded that patriotic Chinese should restore the structure. His proclamation became a well-known slogan: “Let us love our China, let us restore our Great Wall.” Over the past century, even as the walls have grown in symbolic significance, they have steadily deteriorated, victims of new roads and buildings. Last year a foreign organization applied its own phrase to the structure: The World Monuments Fund, based in New York, added the Great Wall to its list of “most endangered sites.” William Lindesay, a British preservationist who lives in

Beijing, has campaigned to save what he calls the “wild wall”—untouched fortifications in rugged natural settings.

Tourist development represents another risk. At Jiayuguan, Yang Yongfu told me that he had put his own spin on Deng’s phrase. “I like to say, ‘Love my China, I’ll rebuild the Great Wall,’” Yang said. “In the past the government restored and protected it. But now I’m the one investing here.”

Yang claims to be the first Chinese businessman to gain permission to rebuild a section of the border walls for his own profit. He is 40 years old, a former peasant who in the late 1980s oversaw the government-funded reconstruction of another local wall section. Yang applied that experience, and an investment of over \$120,000, to his current stretch of wall, which runs through the desert near the Black Mountains. The





Savoring the good life and an enviable view, Western expatriates and others paid \$170 apiece to mingle

**"IT'S NOT ENOUGH TO SIMPLY PROTECT SOMETHING,"
YANG TOLD ME. "YOU HAVE TO ACTUALLY USE IT."**



on a wall-top redoubt at a wine-tasting dinner sponsored by a California vineyard.

surrounding hillsides are riddled with cement-lined bunkers built in the 1960s to defend against possible attack by the Soviet Union. Today the bunkers are abandoned and open to tourists.

When I visited, Yang's workers had already built more than a quarter-mile of tamped-earth walls, burying the original low structure. Tourist admission to the wall would cost 75 cents. Down the road, the government-run section was charging a dollar. Yang said that it wouldn't be hard to turn a profit. After everything I'd seen the ancient walls used for—feng shui, propaganda, cell phone coverage—Yang's defense of pragmatism made perfect sense. Nearly 400 years after the fall of the Ming, the Great Wall had finally become useful.

"It's not enough to simply protect something,"

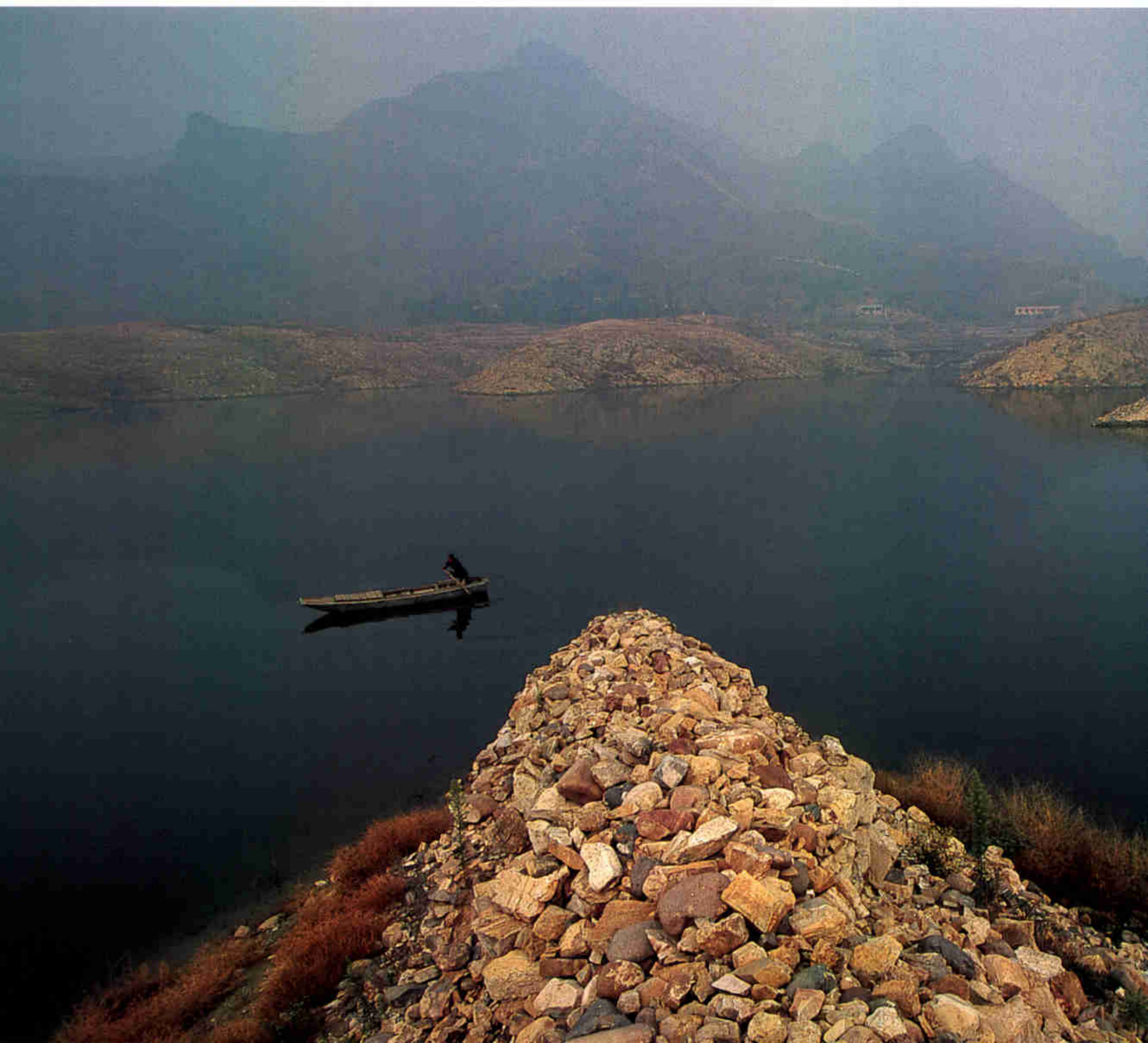
Yang told me. "You have to actually use it. If it's not valued, then sooner or later it will get destroyed."

THE FINAL LINE of Han dynasty forts is in the desert west of Jiayuguan. I was on my way there, passing through the small town of Subei, when I finally got caught.

I had pulled over to use a public toilet. A policeman approached and flashed his badge, telling me that Subei was closed to foreigners, which I hadn't realized. It looked the same as every other place I had passed through that week—snow-topped mountains, open grasslands. I had driven exactly 4,956 miles.

Subei was in an ethnic Mongolian county, and two Mongol officers escorted me to the police

DENG XIAOPING'S PROCLAMATION BECAME A WELL-KNOWN SLOGAN:



station. I assumed the Jeep would be seized; there would be a massive fine; expulsion was inevitable. The region must have been closed because of military installations, ethnic tensions, or poverty—things the Chinese don't want outsiders to see.

Waiting for the interrogation, I wondered if the police might respect the fact that a foreigner had driven alone along the border walls. But I doubted that they would understand my journey. The fortifications had been built to keep people like me out, but now it was clear that the walls' most powerful characteristic wasn't exclusion but rather a sense of narrative. The Great Wall told a natural story, crossing both the landscape and the history of China, and that intersection of time and place touched at the roots of a civilization. And I had

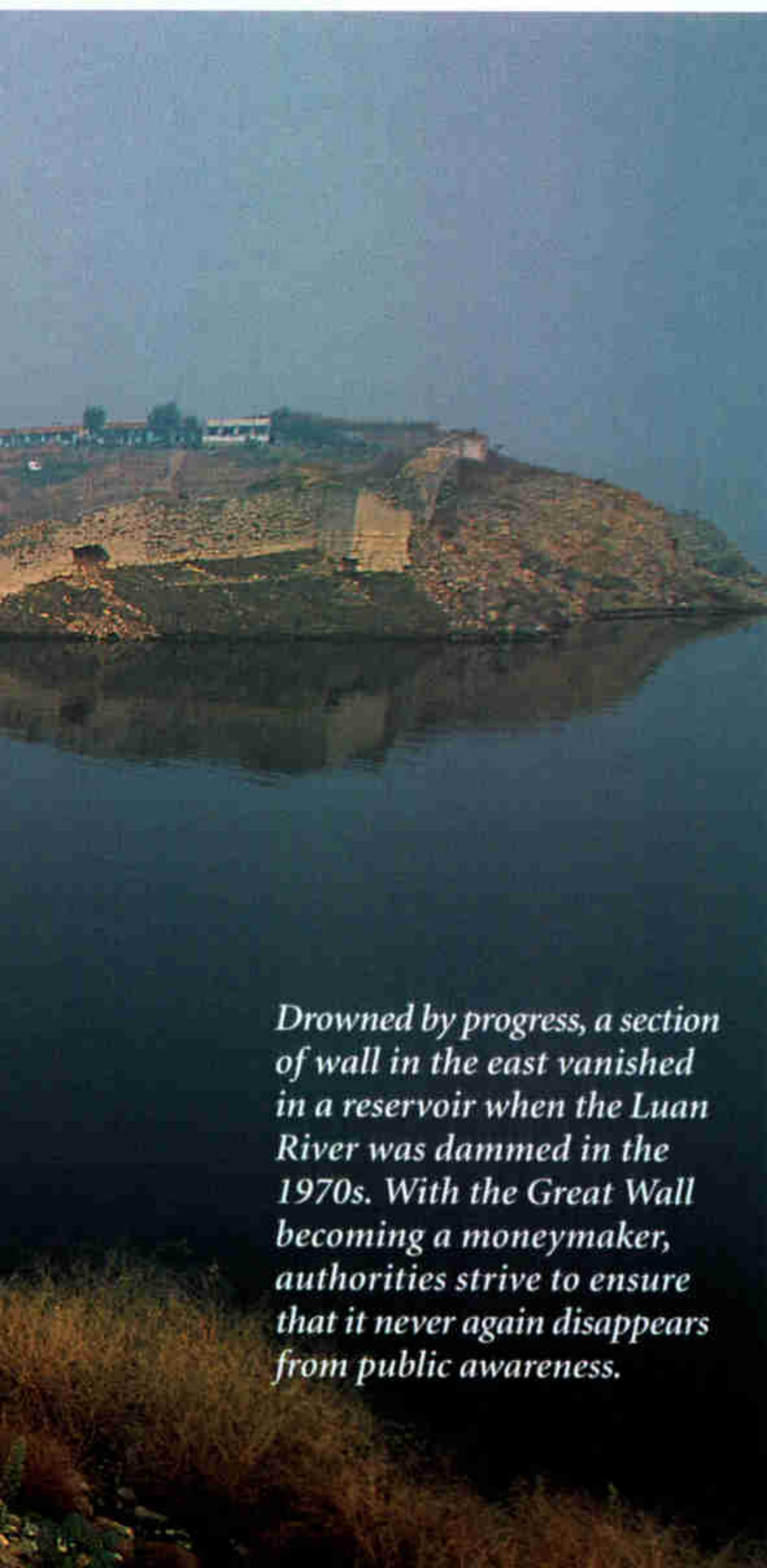
come within a few miles of finishing the story.

The interrogation began. Where was my passport and driver's license? What was my Beijing address? How long had I lived in China? What was my work unit?

They jotted my responses onto official forms. They worked quickly, leafing through dozens of pages, and suddenly I realized that there wasn't any real investigation. There were no phone calls to Beijing, no contact with the foreign ministry. They didn't really care who I was, or why I was in Subei, or where I planned to go next. My threat was purely abstract—the troubling part about foreigners was the idea, not the reality. It was something to be handled with paperwork.

They prepared a confession that said I had violated the national laws regarding closed

"LET US LOVE OUR CHINA, LET US RESTORE OUR GREAT WALL."



Drowned by progress, a section of wall in the east vanished in a reservoir when the Luan River was dammed in the 1970s. With the Great Wall becoming a moneymaker, authorities strive to ensure that it never again disappears from public awareness.

districts. I signed it three times, accompanying each signature with a fingerprint in red ink. Then they announced the fine: twelve dollars.

I wasn't allowed to pay directly—nobody wanted to be accused of corruption—so they escorted me down the street to the local post office, where I mailed a money order. The officers smiled, shook my hand, and left me standing next to my Jeep. As far as they were concerned, the foreigner was already gone.

I kept driving on Highway 215, heading toward the mountains of Qinghai Province. The final Han dynasty fort slipped past; the Great Wall was behind me now. A sign proclaimed: Due to Speeding, 53 People Have Died on This Turn. The highway rose to over 12,000 feet, and I crossed into the vastness of Qinghai. There were no towns, no gas stations, no cars. The land was so empty that nobody had bothered to carve propaganda into the mountains. It looked like the end of the world.

After 25 miles I saw a pair of dirt roads branching off the main highway, marked by a sign. From the words on it, I guessed that the two destinations were government-run—military installations, perhaps. A left turn led to a place called "Build." A right turn went to "Unite." I took a deep breath and drove straight through. □

WEBSITE EXCLUSIVE

Video Views: Travel the Great Wall with photographer Mike Yamashita. Check out behind-the-scenes tales, a photo gallery, and links at nationalgeographic.com/ngm/0301.



What swirls, oozes, spews, goozes,
And makes volcanologists sigh?
The marvelous mountain
With weird lava fountains—
● Tanzania's

Doinyo Lengai

BY JOEL K. BOURNE, JR.
ASSISTANT EDITOR

PHOTOGRAPHS BY CARSTEN PETER





Wings of Stone

Unusually cool and highly fluid lava produces a Dr. Seussian world of geologic whimsies, like this hours-old extrusion frozen in midair. As fragile as a child's drip castle and nearly as short-lived, such bizarre formations result from the world's only active natrocarbonatite flows, which have a chemical composition akin to laundry soap. Exposed to the atmosphere, the lava rapidly hardens and decays. This foot-long wing took flight and shattered within 48 hours.



Mountain of God

Home to the Masai god, Eng'ai, who signals her wrath with eruptions and drought, Ol Doinyo Lengai's current summit rises 7,650 feet above the parched Rift Valley floor, overshadowing the inactive southern crater, top right, that had built most of the young volcano by 15,000 years ago. Pointed hornitos and grayish flows mark recent activity.





“Lava was raining down like

Some people like to climb big granite walls, others frozen waterfalls. Photographer Carsten Peter and his climbing partner Chris Heinlein (right) like to climb erupting hornitos, the sharp, extremely steep hollow pinnacles that sometimes form around active vents. “You can’t compare it to normal rock,” says Peter of this 50-foot hornito, or spatter cone. “It’s very fragile and very unstable. The cone was rumbling and vibrating, but a rock plate was directing the lava in the other direction.” His advice: “Don’t try this at home.”

Though Ol Doinyo Lengai’s fresh natrocarbonatite lavas—which erupt at around 1,000 degrees Fahrenheit—are roughly half as hot as more common basalt lavas, the spattering drops of molten rock will still burn through a cotton jumpsuit like a cigarette through nylons. Yet the dramatic mountain in a remote, little-visited corner of Tanzania invites close inspection, especially from volcanologists. The late photographer and renowned volcano chaser Katia Krafft was captivated by what she called the “toy volcano” because its diminutive flows are cool enough to collect with a spoon. “It’s a perfect little laboratory volcano,” agrees Barry Dawson of the University of Edinburgh, the first to study the strange lavas, in 1960, for the Tanzania Geological Survey. “The shape and style of the extrusions exactly mimic the flows of basaltic volcanos, except the latter are so much bigger.”

Ol Doinyo Lengai (pronounced ol DOYN-yo len-guy) is Masai for “Mountain of God.” It is a place of pilgrimage for Tanzania’s famous pastoralists, who often make the long journey to entreat their god, Eng’ai, for the most important things in their world: rain, cattle, and children. In one of the more common rituals, a Masai elder leads a group of barren women to the base of the mountain, where they pray to Eng’ai to bless them with a child.

Whatever its power, the mountain casts a strong spell over all who visit. “It’s absolutely incredible. Like being on the moon,” says geographer Celia Nyamweru of St. Lawrence University in upstate New York,

who has climbed the mountain a dozen times. Carsten Peter, who has spent a career dodging lava bombs around the world, has climbed it four times in the past 11 years. “I’m addicted to that volcano,” he says.

WEBSITE EXCLUSIVE

Carsten Peter’s hot-footed adventures continue at nationalgeographic.com/ngm/0301. You’ll also find resources and Web links on this and other volcanoes.

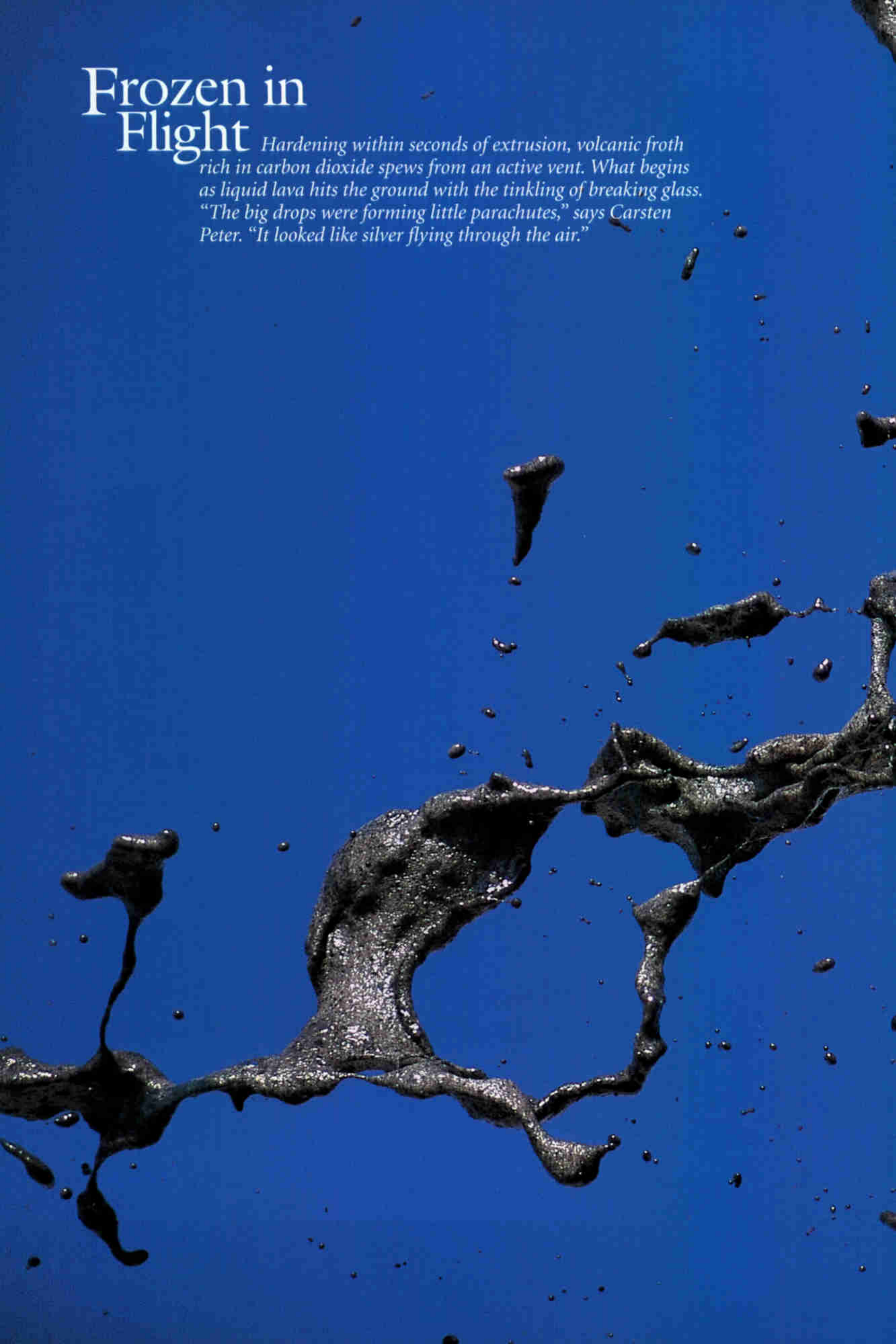


hailstones.” —Carsten Peter

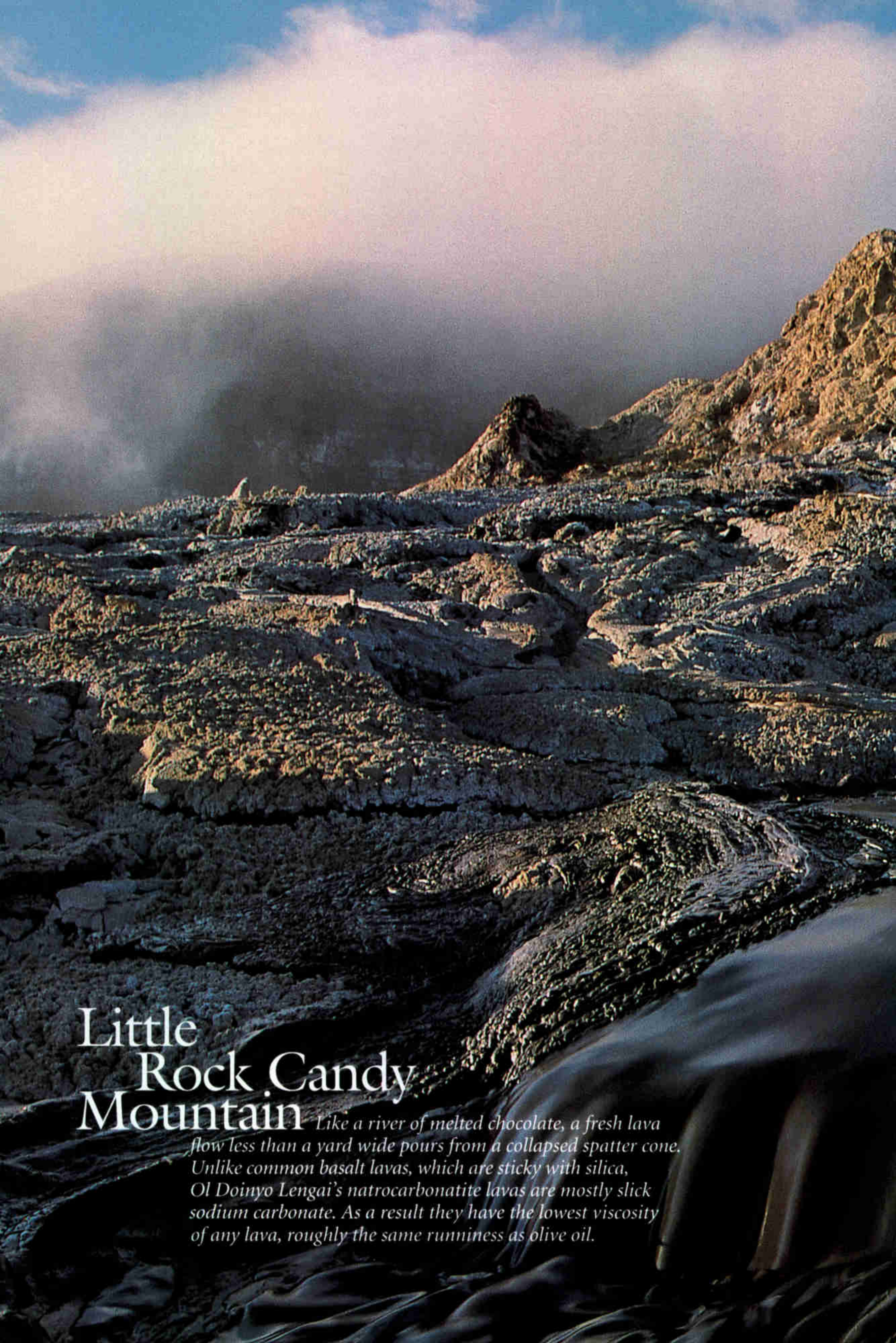


Frozen in Flight

Hardening within seconds of extrusion, volcanic froth rich in carbon dioxide spews from an active vent. What begins as liquid lava hits the ground with the tinkling of breaking glass. "The big drops were forming little parachutes," says Carsten Peter. "It looked like silver flying through the air."







Little Rock Candy Mountain

Like a river of melted chocolate, a fresh lava flow less than a yard wide pours from a collapsed spatter cone. Unlike common basalt lavas, which are sticky with silica, Ol Doinyo Lengai's natrocarbonatite lavas are mostly slick sodium carbonate. As a result they have the lowest viscosity of any lava, roughly the same runniness as olive oil.



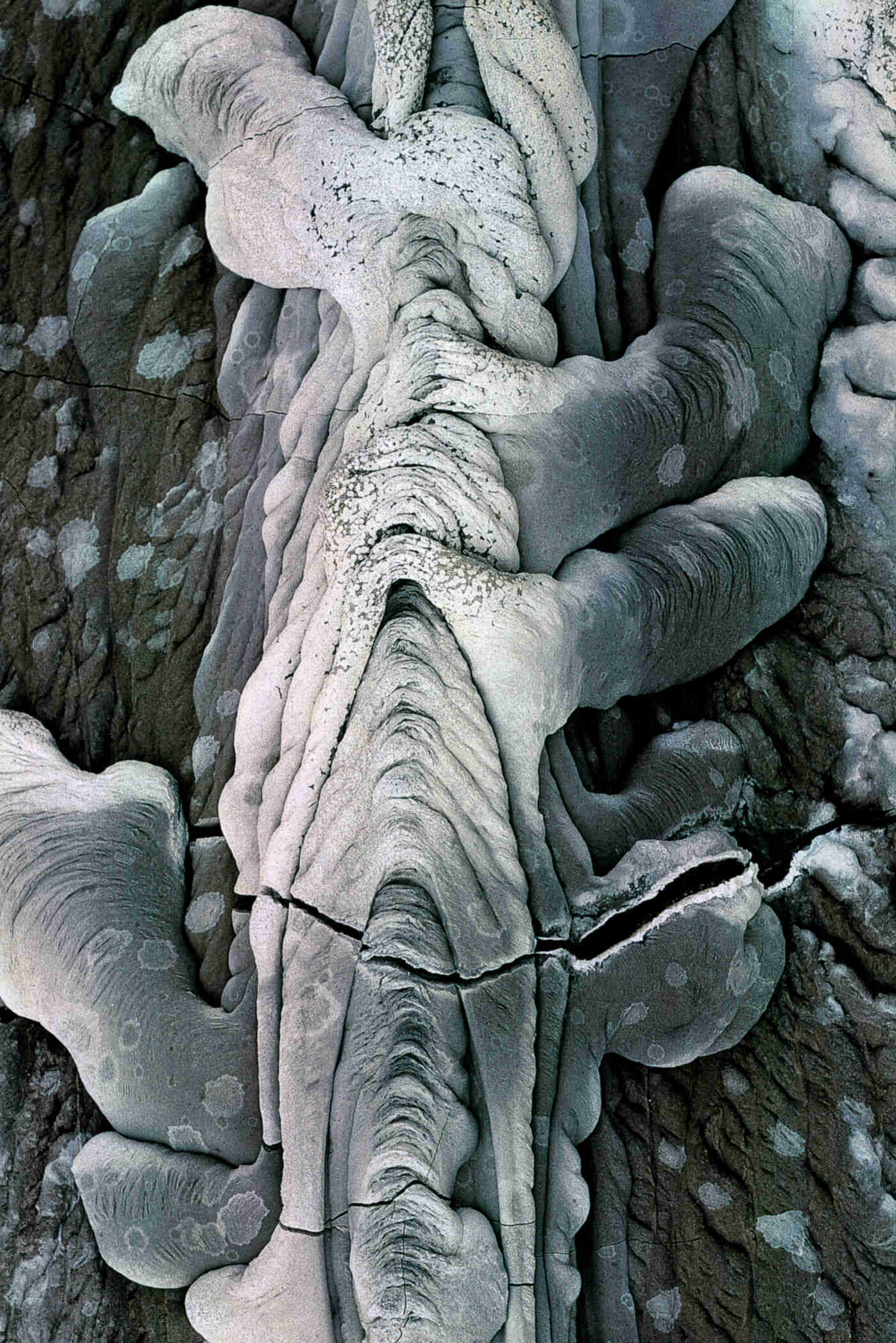


Quicksilver to Ash

A serpentine flow barely six inches wide and 50 feet long (above) meanders through formations of smooth pahoehoe lava and rough aa lava, the same forms common in basalt lavas. Ol Doinyo Lengai's lavas break down so quickly that their age can be judged by their color. Black as oil when they emerge, they quickly shift to muddy browns, grays, and finally frosty white within a few days. Looking like a spotted salamander frozen in stone, a pahoehoe flow (right) reveals the lava's fragility: Even raindrops accelerate its decomposition.

The interior of a collapsed hornito hides a lava lake (below). Carbon dioxide in the lava creates bubbles the size of basketballs that slowly expand, then burst, plastering the rim with spray. This splatter builds the foundation of a new cone.







Fire in the Hornito

On a moonlit night atop Ol Doinyo Lengai, Carsten Peter couldn't sleep for all the volcanic activity around him. He climbed toward an erupting hornito, set up his camera, and held the shutter open as the lava surged forth. The volcano's lavas are barely red to the naked eye. But this long exposure captured the lava's hidden glow—and a bit of the mountain's magic. □



Ever since our ancestors flung a pelt over themselves to shelter against

the cold, textiles have protected us from weather, war, and much else. Now designers envision textiles smart enough to monitor heart patients, strong enough to move buildings, and sophisticated enough to camouflage soldiers in changing terrain.

By Cathy Newman **Photo Illustrations by Cary Wolinsky**
NATIONAL GEOGRAPHIC SENIOR WRITER

Dubar-Warneton and Rubans Gallant, two French companies, created the "Dreamweavers" title by weaving optical fibers into a fabric.





CUSTOM FIT

THE FACE OF THE FUTURE

In a process known as electrospinning being researched at a U.S. Army research center in Natick, Massachusetts, a charged polymer solution is sprayed on a grounded form (in this case a mask). The fibers congeal into a microfiber membrane on the form. Such membranes may initially find use in the making of chemical and biological protective suits, and, subsequently, in seamless formfitting garments.



For quite some time I have had a recurrent dream of floating in air. So when I read about Alex Soza's antigravity jacket, I wondered if my fantasy could, so to speak, sprout wings.

Soza, a young Danish designer, agreed to take me to his studio in Valby, a Copenhagen suburb, to see the jacket, which had just been returned from being exhibited in a museum. Midway through the train ride from my hotel to his studio, his eyes turned heavy behind his fender-thick black-rimmed glasses, and his body slumped. Shortly, he shook himself awake and apologized. "I daydream," he said. "That's how I get ideas."

The antigravity jacket had materialized from such a daydream, he explained. "I was on the subway, and this picture of a floating jacket popped into my mind," he said. "I envisioned a beautiful woman stepping out of a jacket and the jacket remaining suspended."

Unfortunately, my fantasy of floating was not part of the picture; although the jacket itself could float, Soza made it clear it could not levitate the wearer.

In his studio he opened a cardboard box and pulled out the jacket, which looked like a beached jellyfish shriveled by sun. The jacket is made out of two layers of polyurethane membrane quilted into channels into which chemicals can be introduced that react to form helium.

"Could I try it on?" I asked.

Horror crossed his face. "It's too fragile. But it works. I can show you pictures." He handed me a photograph showing the jacket suspended like a bit of ectoplasm in the air.

When I said there didn't seem to be much

practical use for a jacket that just floated and couldn't support the weight of the wearer, he gave me a pitying look.

"It's about imagination!" he said, with the gleam of a visionary. "It's a beautiful dream! It's turning science fiction into scientific fact!"

To be a dreamer like Alex Soza is to be sensitive to sights and sounds invisible and inaudible to the rest of us. Soza—like many dreamers scattered around the globe—happens to dream about new textile systems. But not all flights of fancy get off the ground. Though some soar into reality, others crash-land. Even so, the dream world of high-tech textiles is an exciting place to be these days.

Ever since our ancestors flung a pelt over themselves to shelter against the cold, textiles have protected us from the slings and arrows of weather, war, and much else. At first textiles were made from natural materials like silk and wool. With the invention of rayon at the end of the 19th century, fibers became increasingly sophisticated and versatile.

Now the field is poised on the edge of a new era. The newest generation of textiles may be so high-tech and smart that they take you into outer space, allow you to communicate (by wearing your phone, not just your heart, on your sleeve), and even save your life.

The story of high-tech textiles is about creating fabric strong enough to float a building from one place to another or a camouflage suit that can—with the aid of fiber optics—allow a soldier to disappear into changing terrain. But it is also a story about dreamers who get ahead of themselves and sometimes slip over the edge.

Once upon a time all fibers came from natural sources: wool from the hair of sheep; cotton from a plant with a downy fiber-filled pod; silk from the secretions of a caterpillar, *Bombyx mori*.

"I have often thought, that probably there might be a way found out to make an artificial glutinous composition, much resembling . . .

SPEED DEMONS

FIBERS ON A FAST TRACK

Engine valves made of braided carbon fiber may some day give race cars the winning edge. In a process developed by 3TEX, Inc., of Cary, North Carolina, carbon fibers are twisted into a three-dimensional form, giving them a minimalist sculptural quality. Later they are strengthened and made more rigid. More efficient than steel valves—though more costly to produce—they're igniting interest in the car-racing world, where even small increases in performance matter.



that excrement . . . out of which, the Silk-worm wire-draws his clew,” wrote Robert Hooke, the father of microscopy, in the 17th century. But the first true synthetic fiber would not appear until 1935, when scientists at the DuPont Company invented nylon.

Synthetic fibers are polymers, molecules based on carbon and linked in long chains, typically with hydrogen, nitrogen, and oxygen added on. Polymers can be melted or dissolved and drawn into a thread, and herein lies a difference between synthetic and natural fibers.

“If I tried to melt cotton, it would disintegrate, whereas a synthetic like nylon can be melted and shaped into any form I want,” said Jim Romine, director of Material Science and Engineering at the DuPont Experimental Station in Wilmington, Delaware. DuPont is the biggest manufacturer of synthetic fibers in the world.

Synthetics can do things beyond the reach of natural fibers. Take Kevlar, an early high-tech textile. Pound for pound stronger than steel, Kevlar belongs to a class of carbon fibers called aramids, used in high-strength applications such as antiballistic vests and astronaut tethers. Other high-tech fibers like Nomex and Zylon have high-temperature resistance, perfect for firefighters and race-car drivers.

For the record, Romine was wearing a silk tie, gray wool pinstripe pants, and a blue shirt that was 60 percent cotton, and when I pointed out the predominance of natural fibers in his clothes, it didn't throw him a bit.

“We surround ourselves with textiles. You come out of the womb, and they wrap you in a cloth; then they put you away in a coffin in a cloth.”

“It's a matter of aesthetics,” he said. “I may want the material I wear to drape or look a certain way.” He fingered his tie. “I may want the fabric to rustle. And there is an elite factor.

“On the other hand,” he continued, “if you're a race-car driver, forget cotton or silk. You will put on that Nomex suit.”

“You just wouldn't believe what we're working on,” a colleague of Romine's at DuPont told me with a knowing smile as we sat around a table at the research center. “It'd knock your socks off.” As I waited for the sock-knocking revelation, he added, “Unfortunately we can't talk about it.” The curtain of proprietary rights and nondisclosure had descended—and not for the last time, as it would turn out.

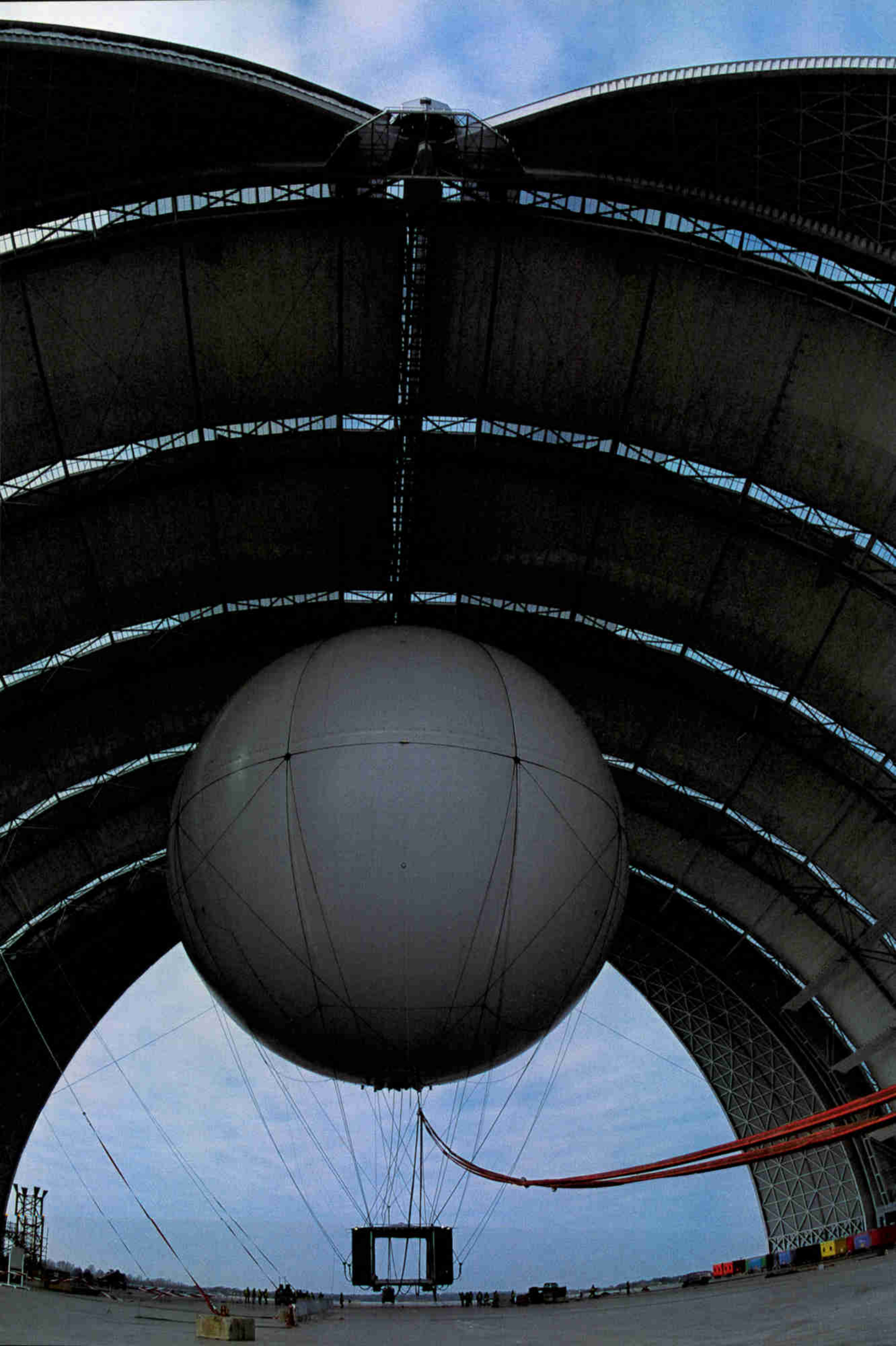
The closed-mouth syndrome is, at heart, a matter of money. Textiles are labor intensive. Much of the textile-manufacturing business has shifted to Asia and Eastern Europe where labor is cheaper. High-tech textiles are seen as a way to resurrect a flagging sector in the United States and Western European countries. Competition is fierce and global in scope. Why give away secrets?

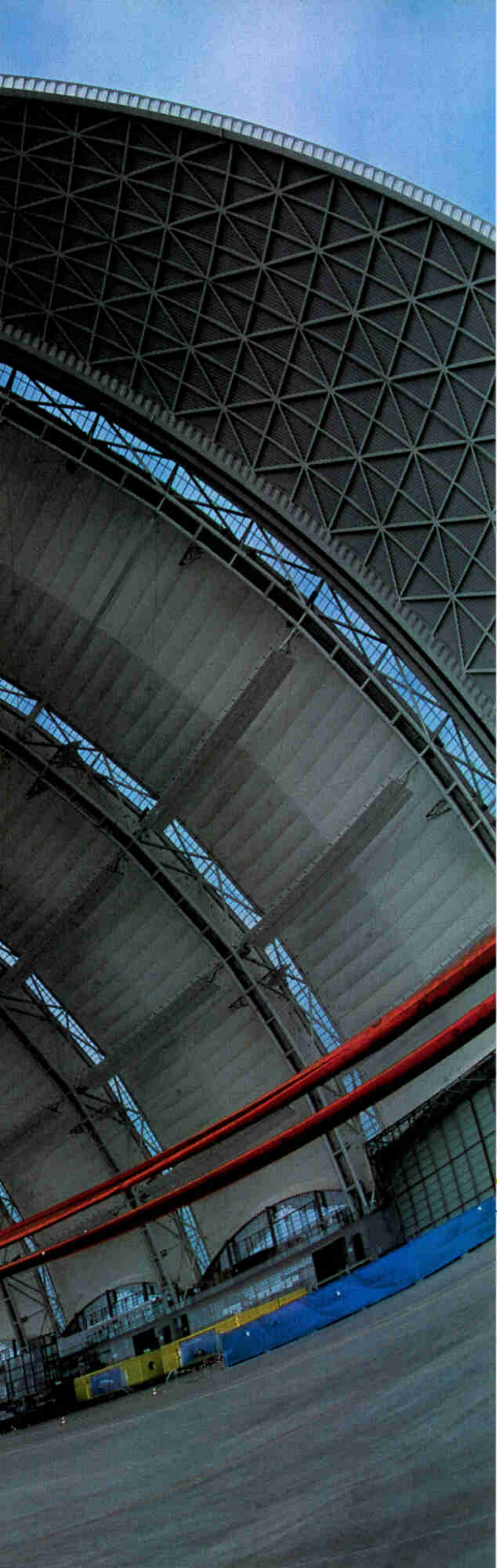
In London I visited Philips Design, a design laboratory run by the European manufacturer Philips Electronics. The studio is a dream-tank for wearable electronics. Among the dreams spun by Philips are an intelligent apron (“This linen apron with integrated power circuit and built-in microphone allows for hands-free operation of kitchen appliances. Turn down a hot plate. Recall a recipe on the screen.”) and the Queen of Clubs outfit (“Here's an outfit for the girl who's really into clubbing. Sensors hidden in her clothes allow her to affect the lights and beat of the music. . . . So that she can make

BLANKET STATEMENT

A COOL WAY TO KEEP WARM

Caught by a thermal camera, an angler on a frozen lake stays warm in a Polartec Heat Blanket. Hair-thin conductive fibers knit into the blanket generate heat when it's plugged into a power source. The fibers, made of modified stainless steel, are durable enough to withstand knitting machines yet pliable enough to be undetectable to the touch. Its launch in 2001 faltered when a defective blanket prompted a recall. The maker corrected the problem and will relaunch this year.





contact with other people across the dance floor, she has pageable pants with lights that flash when someone is trying to get in touch.”), but these, it was explained, were prototypes rather than off-the-rack buyables.

The only market item so far hit stores a few years ago, when Philips collaborated with denim-maker Levi Strauss to produce what was billed as the first wearable electronics jacket. The jacket, called the ICD+, sold for about a thousand dollars. The ICD+ was equipped with an MP3 audio player and cell phone. Headphones were built into the hood, and a microphone was embedded in the collar, but to me at least, it seemed little more than a snazzy-looking jacket with sewn-in wires and pockets.

When I expressed disappointment, Clive van Heerden, director of Intelligent Fibres, pointed out that it was an early first step and a conservative one. “We want to make the jacket that makes the coffee and picks up the kids and keeps track of the shopping list, but it’s not going to happen overnight.”

Van Heerden explained that Philips was working on other products like the jacket, but with advanced technology that actually incorporated the electronics into the fabric itself. Pressed for details, he balked and invoked the shroud of corporate secrecy.

“I would love to tell you more,” van Heerden said, “but our client is absolutely paranoid.”

In a larger sense, high-tech textiles like jackets wired for sight and sound may redefine what

TRIAL BALLOON

CARGOLIFTER'S FLIGHT OF FANCY

Heavy lifting is the strong suit of the CL 75, a prototype flying crane made by German-based CargoLifter. The 20-story-high balloon (human figure against the shaded sphere above shows scale) made of fabric as thin as a windbreaker can hoist 75-ton loads, making it ideal for transporting a locomotive or setting up an oil-rig platform. The 350-foot-high hangar, made of another superstrong membrane, is large enough to house 14 jumbo jets.

Such dreams made my head spin. Spider silk pulled from the milk of a genetically altered goat, a smart bra that knew when to shape up. . . .

clothes are all about. “In the past, clothing protected us from the elements,” said Ian Scott, head of technology for women’s wear at British retailer Marks & Spencer. “Then clothing became about fashion. The future is about clothing that can do something for you. It’s no longer passive. It’s active.” In the next few years, M & S hopes to introduce an “intelligent bra,” a sports bra that can sense stress and adjust its dimensions to give perfect support. “We’re not divulging how it works,” Scott said. Somehow, I was not surprised.

Jeff Wolf, head of a small start-up called Sensatex in New York City, enthused about a smart T-shirt with conductive fibers that feed into a small transmitter that can monitor vital signs like heartbeat, blood oxygen, respiration, and body temperature—and that’s just for starters. He showed me a prototype, which looks pretty much like an ordinary T-shirt, but of thicker material—similar to an Ace bandage—with several ports for phone-jack-like connectors. Down the road, he explained, sensors that carry light and video can be incorporated into the shirt, as can a GPS signal.

Its inventor, Sundaesan Jayaraman, a professor at the Georgia Institute of Technology, envisions applications such as monitoring babies at risk for sudden infant death syndrome, keeping tabs on post-surgical geriatric patients at home, and making sure firefighters on the job don’t suffer from heat or other physical stress. “I call the shirt a wearable motherboard,” Jayaraman said. “There’s no limit. We can plug in as many sensors as you want.” The information travels via conductive fibers woven into the shirt to a small wireless transmitter, which will send the information to be interpreted wherever you specify—say your doctor’s office or hospital monitoring station.

In the future, clothes won’t just sit there. They’ll be primed to *do something*. Though the potential of a product like Jayaraman’s smart shirt is impressive, just how active and garrulous we’ll want our street wear to be is another matter.



SPIDER GOATS

A NEW SPIN ON NATURE

In a digitally manipulated image, goats hang by a thread to make a point. Goats bred by Nexia Biotechnologies in Montreal contain a spider gene that causes a spider-silk protein to be expressed in their milk. This protein is being used in a new fiber that’s five times as strong as steel, with potential application in bulletproof vests.

“Do you really want your clothes to talk to you?” I asked Katharine Hamnett, a forward-thinking London designer noted for no-holds-barred opinions.

“Absolutely not,” she said. “Imagine what they’d say. Things like ‘you liar.’ Besides, there’s enough chatter in the world.”



CARY WOLINSKY, BARBARA EMMEL, DAVID DERANIAN

"I'm opening my box of toys," Hugues Vinchon promised. Vinchon is an executive with Dubar-Warneton, a manufacturer of technical textiles in Wattrelos, a French town near the Belgian border. As we sat in a conference room in the company offices, he pulled out samples of his inventory like a magician pulling scarves from a hat.

First it's a swatch of oil-eating textile, which absorbs five times its weight in oil (the perfect mop for petrochemical spills); then a fabric that absorbs vibrations ("Can you imagine a motorboat you can't hear?" he said); finally an ordinary looking cloth bag. "Completely water soluble," he said. "It's strong enough to carry heavy objects. But if I dip it in boiling water it disappears. Unfortunately I am a little ahead of

myself. I only have one potential customer for this vanishing fabric."

"Who?" I asked.

"The French Atomic Energy Commission. But they won't tell me how they intend to use it."

On the other hand, the U.S. Army Soldier and Biological Chemical Command center in Natick, Massachusetts, is happy to play show-and-tell (within limits). At Natick, as the center is known, researchers develop materials needed to clothe and shelter military personnel. "I take frostbite personally," a scientist in the textile division told me. "My son-in-law is a marine, and he suffered frostbite on a mission once."

High-tech textiles are everywhere at Natick. There are research projects focused on air beams, inflatable high-strength fabric tubes that would

“Clothes won’t just sit there.”

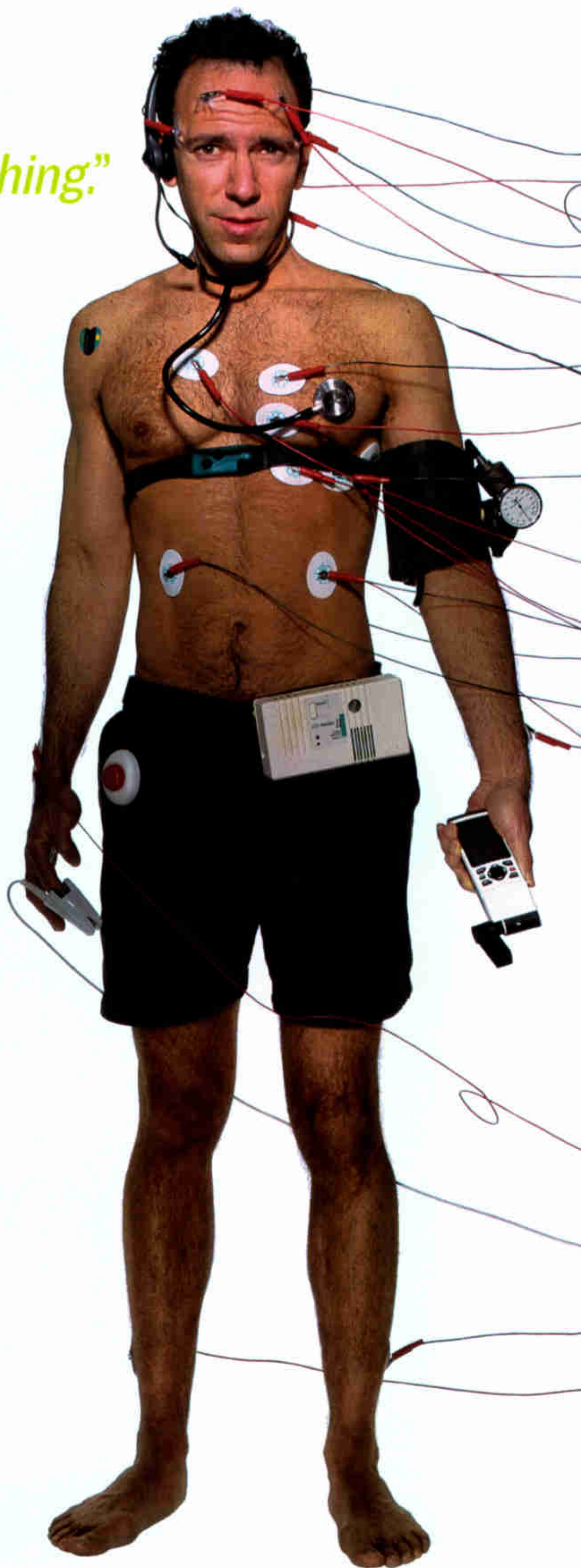


They'll be primed to *do something.*"

allow a team to erect an airplane hangar in a fraction of the time a conventional metal structure would take (pages 66-7). The largest air beams, about 30 inches in diameter and 80 feet long, are so strong you can hang a fully armored Humvee from one. Yet they pack down into the back of a truck. "We have a team of guys who run around the world setting up metal-frame maintenance hangars," said Jean Hampel, the engineer in charge of the project. "It takes ten people five days to set one up. We can set one made of air beams up with six people in two days."

In another building, Quoc Truong worked on an amphibious suit for Navy SEALs that can take them from water to land and back to water again. SEALs on a mission have to wear a wet suit and then carry and change into clothes for use on land, Truong explained. "So the Navy came to us and asked us to develop a single suit that does both." The answer, he believes, is a paper-thin membrane made out of a material manufactured by the Japanese company Mitsubishi Heavy Industries that is sandwiched between two layers of stretchable polyester fleece. On land the membrane opens up, allowing heat to escape. In water the membrane closes down, retaining body heat and minimizing heat loss. The suit is currently being tested.

In the lobby of Natick's headquarters I could view a life-size model of the Future Warrior 2025, a soldier mannequin dressed to kill. The body-hugging black suit and helmet combine the sleekness of a racing skater with the menace



SMART SHIRT

WEARING YOUR HEARTBEAT ON YOUR SLEEVE

Jeff Wolf, CEO of Sensatex in New York City, models the smart shirt developed by Sundaresan Jayaraman, a professor at the Georgia Institute of Technology. The shirt contains conductive fibers that can monitor vital functions, including heart rate and respiration. This information can be transmitted by wireless signal to a remote location such as a hospital or doctor's office. Conventional monitoring requires a cumbersome tangle of wires (worn by Wolf at right).





CARY WOLINSKY AND DAVID DERANIAN

DISAPPEARING ACT

INVISIBILITY AS THE ULTIMATE CAMOUFLAGE

As part of the Future Warrior program at a U.S. Army research center in Massachusetts, researchers are developing uniforms that will transmit visual information—about color, light, even pattern—through the fiber. Using photographs from a studio and on the street, this digitally manipulated computer image shows how two soldiers would virtually disappear into the background.

“You just wouldn’t believe what we’re working on. It’d knock your socks off. Unfortunately we can’t talk about it.”

of RoboCop. Future Warrior 2025 is a military wish list for what the well-dressed combat soldier will wear by the end of the first quarter of the 21st century. Among other marvels, the suit will incorporate communications hardware, monitor the wearer’s physical condition, tell commanders the location of every soldier, be able to sense light from the environment and adjust camouflage patterns accordingly, and protect against ballistics, radiation, and chemical and biological agents.

“Someday we may have robots, but right now the soldier is the most important thing on the battlefield,” said Tom Tassinari, a Natick scientist. “Men and women fire weapons, fly planes, and drive tanks. Protecting that individual is one of our key missions—and I mean not just protection from bullets, but from climate, flame, lasers, biologicals, chemicals, and radiation.”

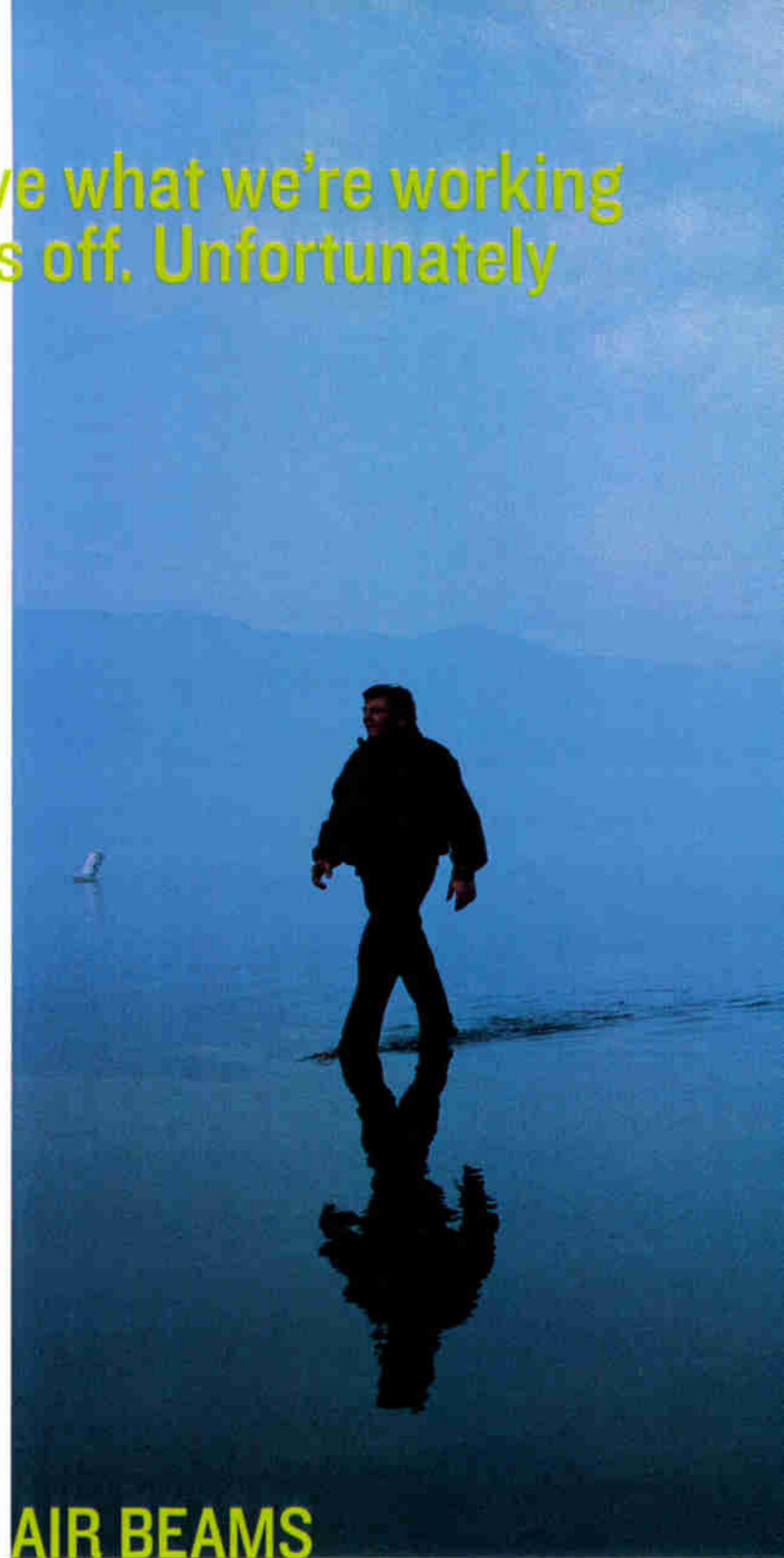
“It’s a grim business you’re in,” I said.

“Just the opposite. I’m trying to prevent death. I don’t think I could handle the other end of it.”

At Natick, scientists are also playing with the idea of an instant suit. “It’s blue-sky stuff,” admitted Carole Winterhalter, a textile expert. To make the suit, she suggested, you’d have a machine (and these already exist) that would scan your body with lasers and calibrate your dimensions. The heads of the lasers would be combined with a nozzle that would spray and wrap a polymer fiber around your contours to create an instantly fabricated, formfitting uniform ready for the battlefield or mess hall. “Instead of making a fiber, spinning it into yarn, weaving it into fabric, cutting and sewing it into clothes, you’d go from fiber to garment with none of the steps in between,” she said.

Of course, when you think about it, that kind of system has been in operation for eons. A spider goes directly from polymer fiber (spider silk) to application (a web). As usual, nature was there first.

“My company is based on the lessons of the spider,” said Jeff Turner, as he picked up a plush spider toy the size of a dinner plate, started to



AIR BEAMS

ONE HANGAR TO GO, PLEASE

Inflatable fabric beams arc over Lake Elsinore in California. When aligned to carry a fabric roof, the beams, developed by Vertigo, Inc., for the U.S. Army, can be configured into a portable aircraft hangar. The larger beam spans 80 feet, rises to a height of 33 feet, and can be packed into the back of a small pickup. “It’s strong enough to hang an SUV from,” says Vertigo CEO Roy Haggard.

show it to me, then stopped as concern flashed across his face.

“You’re not arachnophobic, are you?”

Turner, 42, heads a start-up biotech company in Montreal called Nexia Biotechnologies, whose big-bet project is the production of spider silk. Spider silk is the ultimate fiber dream. It is



five times as strong as steel, yet has tenacity, or stretch, making it ideal for many applications. Turner, whose energy level resembles one of those Quebec mega-hydro dams, was leaping with excitement as he explained the concept in Nexia's offices.

"Spiders are making high-impact materials right before your eyes," he said. "And it only took them 400 million years to get there. Nature is a series of solutions to questions of survival. In looking at a web, we're looking at the end point of a life-and-death game that has been playing for years. The game rules say you only have what is on this table—20 different amino acids. The spider has taken the same amino acids that are in your hair, skin, body and has put them together to make a

beautiful continuous filament with perfect crystallinity. And it's truly biological; no high temperatures or noxious chemicals needed for manufacturing."

Unfortunately, spiders can't be farmed. They're cannibalistic. So Turner's group has come up with an alternative. Introduce the spider-silk-protein gene—which only affects the mammary gland—into the genetic makeup of a goat. Take the spider-silk protein out of the milk. Process the protein. Spin it. *Voilà!* Spider silk by way of goat milk.

So what does a goat that has a spider-silk-protein gene look like? Like any other goat, it turns out. After all, Turner said, the genetically modified goat has 70,000 ordinary goat genes and a single spider-silk-protein gene. As for the





HOT COUTURE

PYROMAN AND BO SWEAT IT OUT

Bo (above), a sweating mannequin made of copper, tests military clothing for breathability at a U.S. Navy research facility in Massachusetts. The one-of-a-kind Bo was built in Seattle for \$860,000. His counterpart, Pyroman, at North Carolina State University, evaluates protective clothing worn by firefighters and welders. Propane torches capable of producing temperatures in excess of 2500°F simulate flash-fire conditions in a chamber.

“The industrial revolution came about because of steel. Computers came from silicon. We are about to enter the age of bio-mimicry. It’s back to nature.”

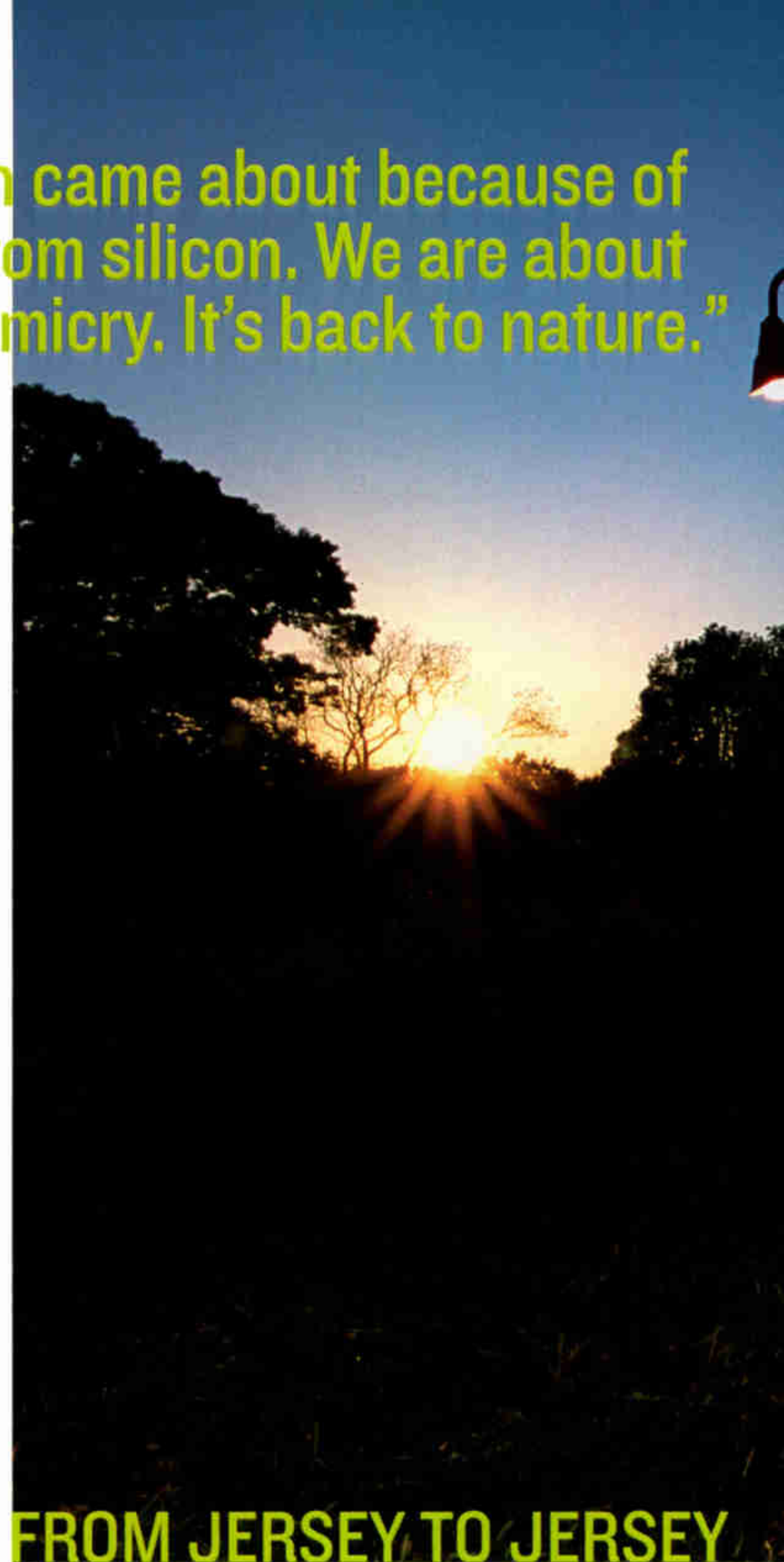
ethics of tampering with a goat’s genes, Turner pointed out that the goats aren’t harmed. “Why are people afraid?” he asked rhetorically, then answered his question: “People fear newness; people fear change.”

Production of spider silk is at least 18 months away, but already Turner envisions applications for the new material, called BioSteel. First on the market, he said, would be suture thread for eye surgery finer and stronger than today’s nylon, then antiballistic vests and biodegradable fishing lines. In the far-out future-applications department, Turner proposes a space elevator. “Why use rockets to lift objects into orbit? Why not do something different? Why not have a honking big satellite and dangle a rope down to the Earth and pull them up? OK—so it’s 200 miles, and there’s not a rope that will hold its weight at that length—but spider silk with its high strength-to-weight ratio could.

“Civilizations define themselves by the materials they use,” Turner said. “The industrial revolution came about because of steel. Computers came from silicon. We are about to enter the age of bio-mimicry. It’s back to nature.”

The biggest trial balloon I’ve ever seen sits like a giant pearl in a clamshell-like hangar made of a textile membrane four football fields in length and 35 stories tall in Brand, Germany, an hour’s drive south of Berlin. It is called the CL 75 (CL stands for CargoLifter), and it is a 20-story-high balloon made of high-tensile-strength fabric that is really a test craft for an even larger lighter-than-air ship, to be built sometime in the next five years. The CL 160 is a modern-day version of dirigibles like the ill-fated *Hindenburg*. Unlike the *Hindenburg*, which was filled with hydrogen, the CL 160 will use noncombustible helium.

The CL 160 will be larger than the *Hindenburg*, and its envelope will be made of 420,000 square feet of a high-strength fabric known as Vectran. The dirigible will be in the business of heavy lifting. It will move huge factory



FROM JERSEY TO JERSEY

TURNING MILK INTO SILK

Dunebuggy, a purebred Jersey belonging to Peter Hawkes of Mendon, Massachusetts, models a blouse knit from a silklike fiber made of casein, a protein found in milk. In a reflection of the global nature of new textile research, the fiber was manufactured by Toyobo in Japan, spun into yarn by Filpucci in Italy, and knit into fabric by Frantech in France.

turbines or structural steel beams or oil refinery equipment from one place to another without worrying about obstacles like roads, power lines, or traffic. But to watch Hinrich Schliephack, CargoLifter’s marketing director, and other company executives dream up applications is to sense that the sky is literally and figuratively the limit.



“We can use it for tourism,” one executive suggested. “Instead of building a new hotel in a new location, simply move the hotel. Today Angel Falls! Tomorrow the Serengeti!”

“The government of India is interested in using it to fly Muslim pilgrims to Mecca,” said another, as the incredulity index continued to rise. “You could pick up a whole village!”

How much will CargoLifter spend before it carries its first payload? I asked.

“About half a billion dollars,” Schliephack said.

“And if it doesn’t get off the ground?” I said. He shrugged; failure is out of the question. “We’ll just have to convince everyone!”

Unfortunately, the company’s creditors weren’t among the convinced. Last summer a series of financial ups and downs led CargoLifter

to file for insolvency. Despite a modest four-million-dollar government loan, the project may be grounded for good.

Meanwhile, the French have their own super-size lighter-than-air-craft project in the works. The project, still on the drawing board, will engage a consortium of French textile and aeronautic companies and government agencies to create a cylindrical shaped lighter-than-air craft capable of lifting 500 tons.

“Suppose you have to change jobs and move to a new city,” said Patrice Gallant, a high-tech textile manufacturer in Lille, France, joining the dreamstakes.

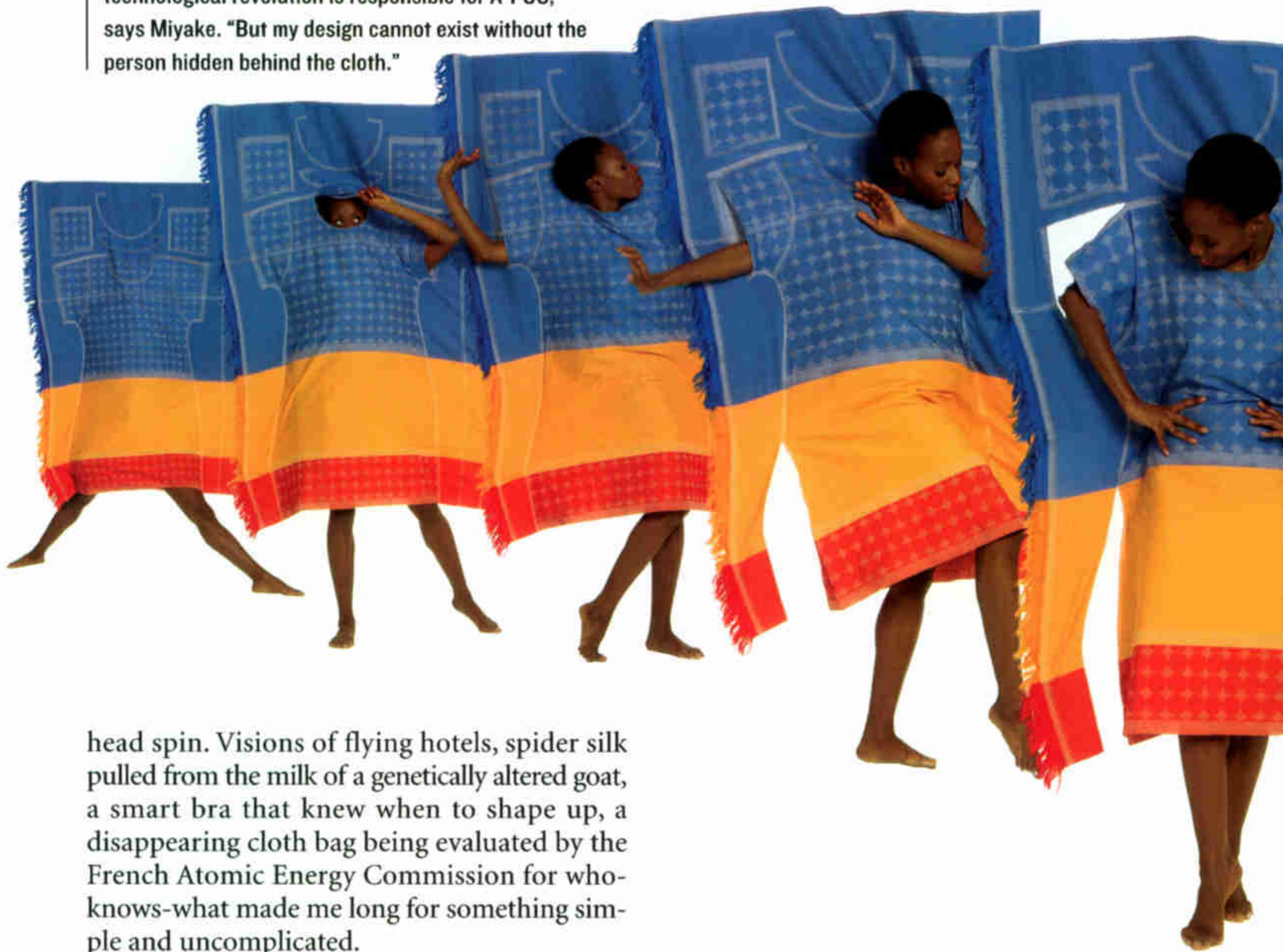
“Instead of buying a new house, you move your existing house!”

The size and scope of such dreams made my

CUT AND RUN

MIYAKE'S AVANT GARB

A dress from Japanese designer Issey Miyake's A-POC collection (short for A Piece of Cloth) is woven into fabric then liberated by cutting along the lines, as shown by Alvin Ailey dancer Dwana Adiaha Smallwood. "The technological revolution is responsible for A-POC," says Miyake. "But my design cannot exist without the person hidden behind the cloth."



head spin. Visions of flying hotels, spider silk pulled from the milk of a genetically altered goat, a smart bra that knew when to shape up, a disappearing cloth bag being evaluated by the French Atomic Energy Commission for who-knows-what made me long for something simple and uncomplicated.

Something, it turned out, exactly like the bright yellow pillow the size of a magazine that Asha Peta Thompson showed me at the Design for Life Centre at Brunel University in the south of England.

"It's a television remote control for somebody with motor-skill problems," Thompson, a weaver, explained. The pillow, which has large numbers and volume control icons embroidered on it, relies on a switch made of a layer of mesh sandwiched between two layers of copper-coated nylon, allowing a person lacking manual dexterity and strength to manage the controls.

It was functional, simple, and fun. It should be, Thompson explained. She has the admirable mission of not only designing products for people with disabilities but also making those

things so appealing that able-bodied people will want them too.

Thompson also showed me a soft fabric mat that a child with cerebral palsy could sit on and, by leaning forward or back, use as a joystick for video games. The marriage between textiles and technology made perfect sense, she said. "We surround ourselves with textiles. You come out of the womb, and they wrap you in a cloth; then they put you away in a coffin in a cloth. When you get out of the bath, you wrap yourself in a towel. It seems natural that what we wear should be combined with technology."

Dreamweavers I met like Asha Thompson are creating astonishing things. Who could resist a textile that could communicate with the world, even save your life?



True, all the wrinkles haven't been ironed out yet. The high-flying German CargoLifter floundered. The antigravity jacket created by Alex Soza deflated my hopes of flying when it turned out to be a wisp of fantasy. The high-tech electric blanket Malden Mills CEO Aaron Feuerstein showed me in Methuen, Massachusetts, had to be recalled when a blanket sold by the retailer malfunctioned.

Still, there is something wonderful about the impulse to create textiles that can perform such

feats and still make it through a permanent press laundry cycle.

What's so significant about this blanket? I asked Feuerstein, the day he unveiled his soon-to-be-marketed product. The blanket was soft, flat as a pancake, washable, and heated by stainless-steel fibers manufactured by a secret process.

"It takes a business as old as civilization and throws us into the 21st century," he said, rubbing his hands together with the glee of a child on Christmas morning. "It's a technology platform. Today a blanket, tomorrow a wireless heated stadium blanket, a sleeping bag, or a jacket."

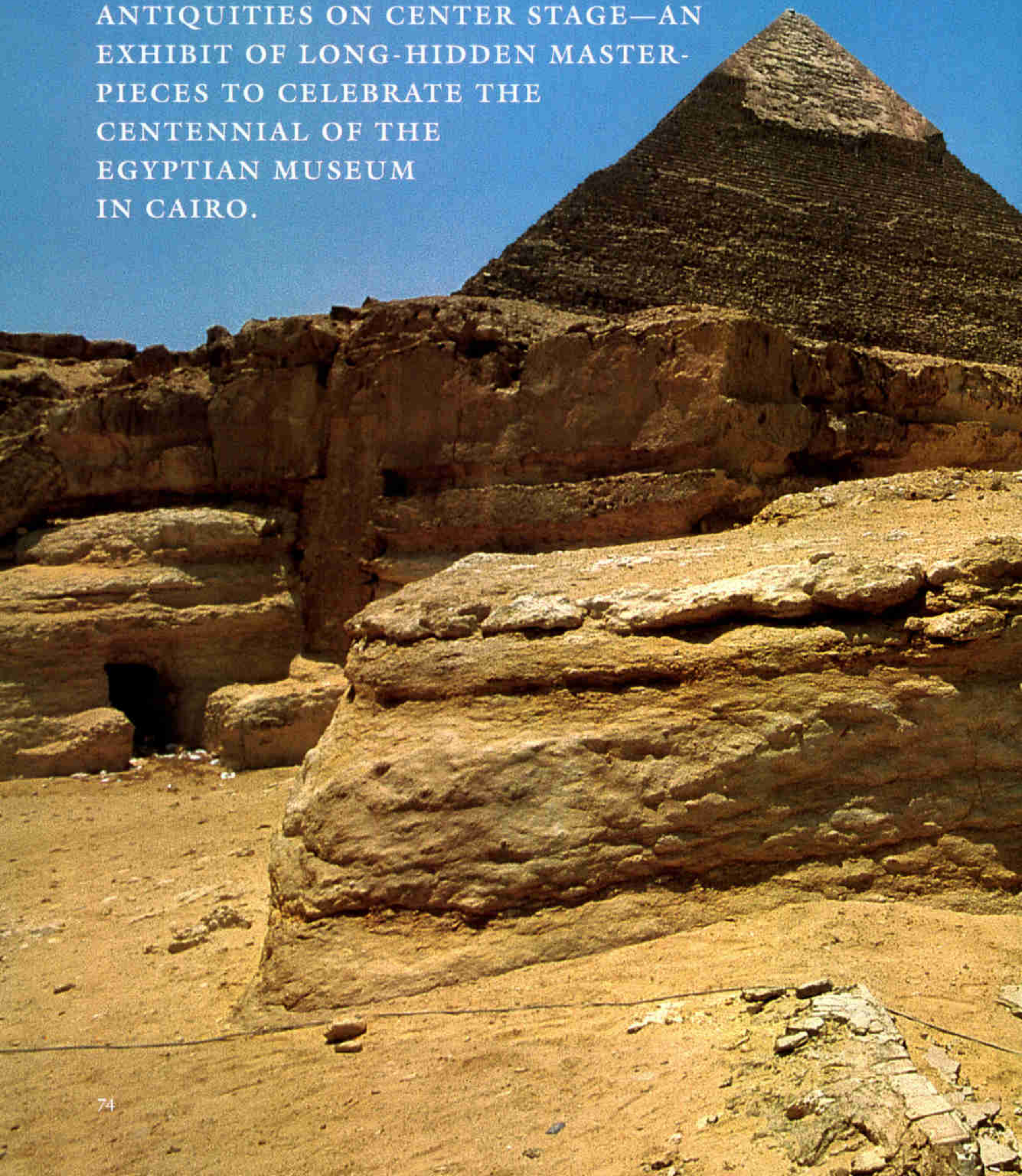
Dream on. □

WEBSITE EXCLUSIVE

Photographer Cary Wolinsky shows what's possible when textiles merge with technology in video clips online at nationalgeographic.com/ngm/0301.

EGYPT'S FOR

SEEING DAYLIGHT AFTER 40 YEARS IN THE DEPTHS OF A GIZA STOREROOM, THIS 4,500-YEAR-OLD STATUE OF A SCRIBE EMERGES TO JOIN OTHER ANTIQUITIES ON CENTER STAGE—AN EXHIBIT OF LONG-HIDDEN MASTERPIECES TO CELEBRATE THE CENTENNIAL OF THE EGYPTIAN MUSEUM IN CAIRO.



GOTTEN TREASURES



BY ZAHİ HAWASS

SECRETARY GENERAL, SUPREME COUNCIL OF ANTIQUITIES, EGYPT
NATIONAL GEOGRAPHIC EXPLORER-IN-RESIDENCE

PHOTOGRAPHS BY KENNETH GARRETT

The brilliance of ancient Egypt, as revealed by excavations in the 1800s, filled the Egyptian Museum at its opening on November 15, 1902. Since then, legendary archaeologists have uncovered many times more riches—grand statues, mysterious mummies, and Tutankhamun's gold. Much of this made its way to museum galleries, but much also vanished into the obscurity of dim storerooms before ever being studied or displayed. This past summer I launched a search of the entire Egyptian Museum as well as



ALABASTER GLOWS as Zahi Hawass illuminates an inscription on a ritual bowl unpacked moments earlier in the Egyptian Museum's basement. "This piece is one of a kind," says Hawass. "It bears the name of Khufu, the king who built the Great Pyramid at Giza." A granite sarcophagus cradled in foam came from a storeroom at the royal burial ground of Saqqara. The lid, carved in the image of its owner—believed to be a high official around 1350 B.C., the time of maverick King Akhenaten—emerged in excellent condition. Restorer Ahmed Orabi pieces together the badly damaged base.

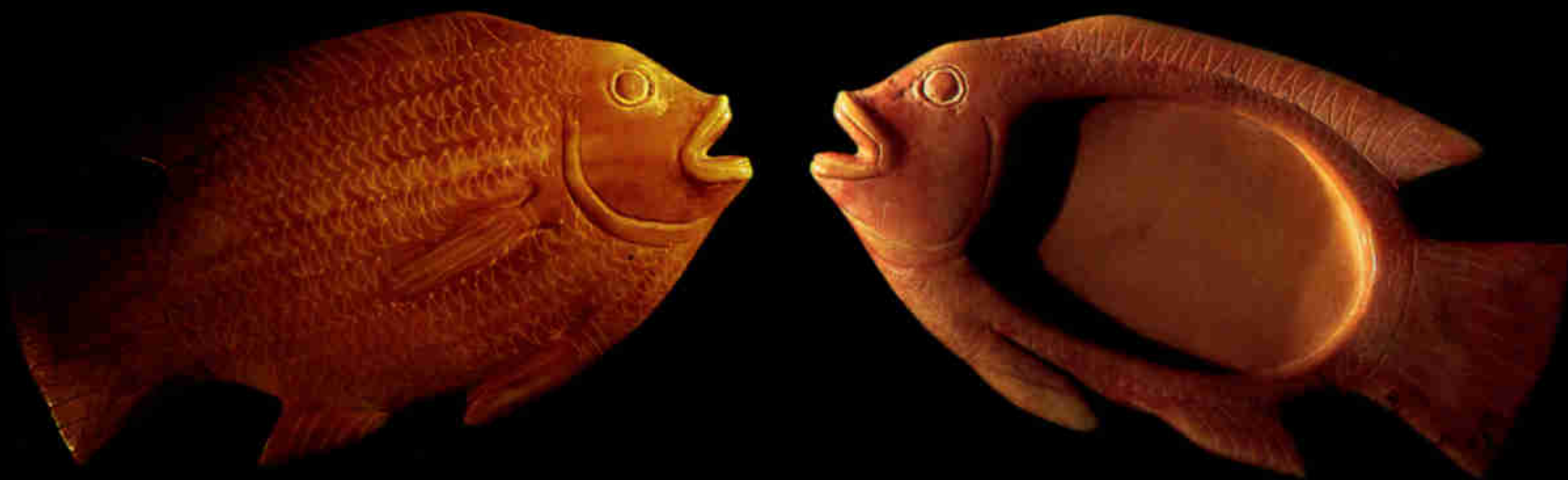




POLITICS AND VANITY



MINGLE IN STONE



THE EARLIEST KNOWN SYMBOL of unified Egypt ever found in the Nile Delta was carved on a cosmetic palette (left) from a cemetery of the first dynasties in Manshaat Ezzat. Long-necked beasts joined at the head represent formerly separate realms, Upper and Lower Egypt, ruled as one from about 3000 B.C. A soapstone ointment holder—shown front and back (above)—lay in the tomb of Aperel, Akhenaten's vizier, at Saqqara.

storage sites around the country to find material for an unprecedented exhibit, which opened last month. The result, including works never seen by modern scholars, is a dazzling tribute to one of the world's great civilizations.

At the height of summer's heat, with the museum's centennial only months away, my exhibit team hit the road in high gear. Racing across Egypt (map below) in two weeks, they selected hidden gems that span 3,000 years, from the earliest kings to Greco-Roman times.



Meanwhile, workmen rushed to transform a corner of the museum's basement into exhibit space. What was once a rarely entered maze of dusty, airless passages packed with crates became the setting for an adventure into Egypt's glorious past.

As I oversaw all this, I couldn't help but recall that a statue had temporarily disappeared in the turmoil of bringing objects to the museum in 1902. Today, tight security prevents such mishaps. Before entering each excavation storeroom, my exhibit team had to cut away lead seals stamped with the name of the last official in charge. Once selected, objects rode crated or wrapped in foam in armed convoys of trucks, which sped along highways and wove through Cairo traffic to reach the museum's guarded back entrance. Curators then unpacked everything in the basement and prepared each piece for its starring role.

The people who created these artifacts are long gone, their tombs buried in the sand, their names lost. But our museum will keep their legacy alive in a new millennium.

WEBSITE EXCLUSIVE

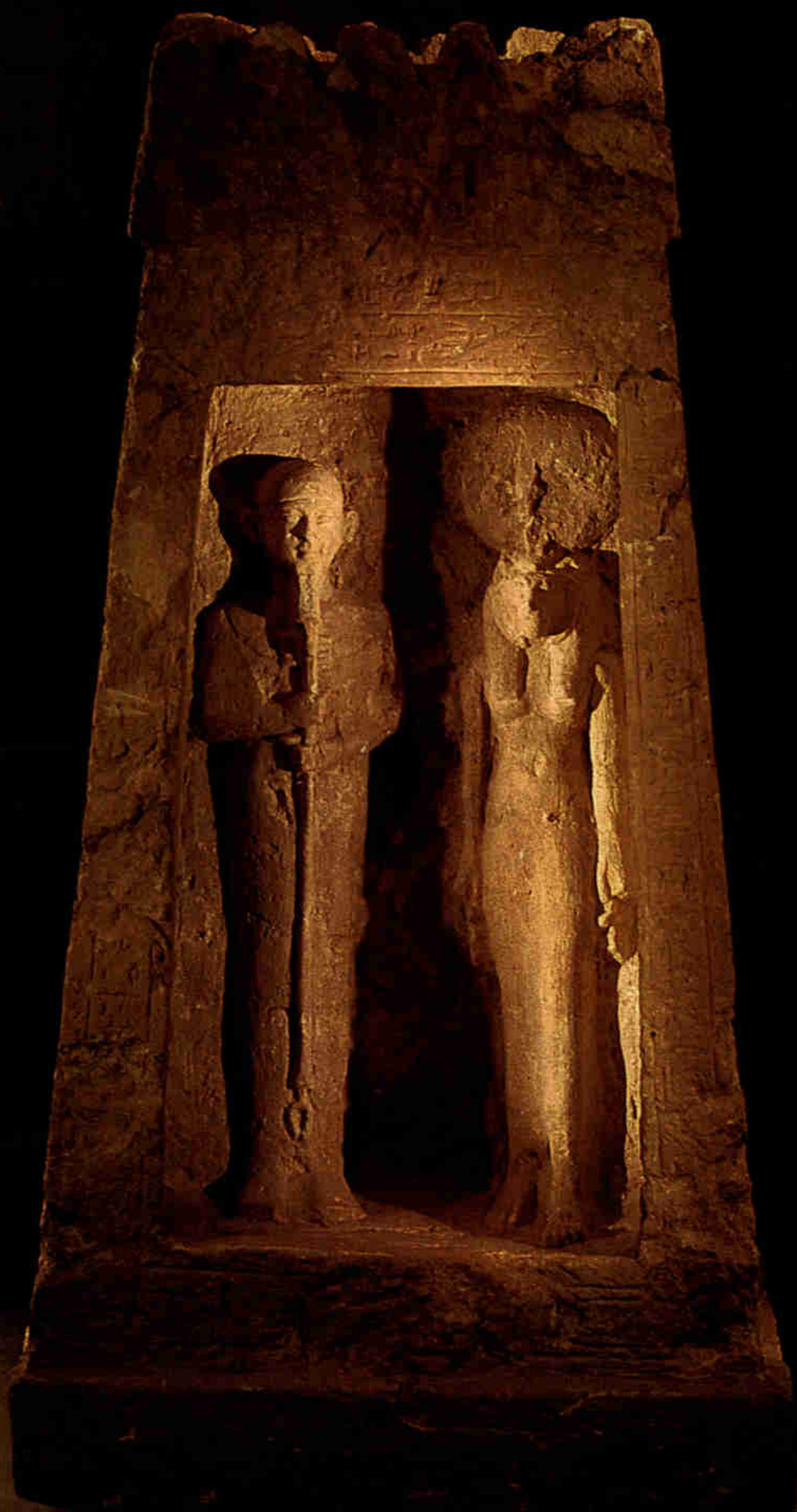
Explore the dark corners of the Egyptian Museum's basement and learn more about its 100th birthday bash at nationalgeographic.com/ngm/0301.

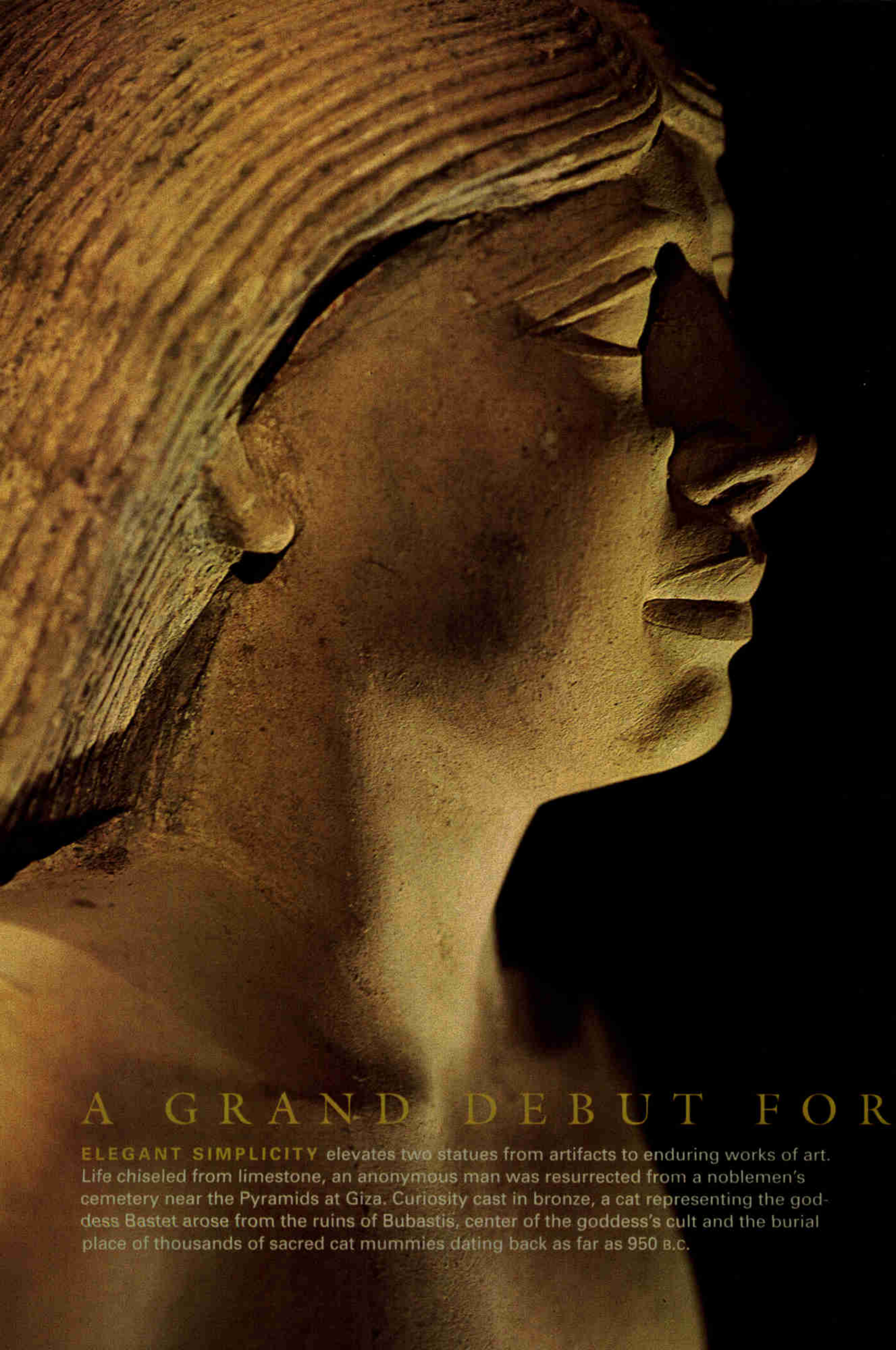
GLORIES OF EGYPT'S



GOLD FLASHES as a workman's hands gently pull back cotton packing to reveal a woman's funerary mask from Tell el Sowwah. Made of linen and plaster, the gilded and painted face is probably a fair likeness of the deceased. A crate from Abydos contains tiny limestone coffins topped with golden shrews (left). Mummified remains of the animals lie inside. "Shrews were related to the sun's nightly renewal," says mummy conservator Abeer Helmi. "People presented them as offerings, like candles in a church." A tower-shaped shrine (right) from Marsa Matruh holds images of the god Ptah and his consort, lion-headed Sekhmet.

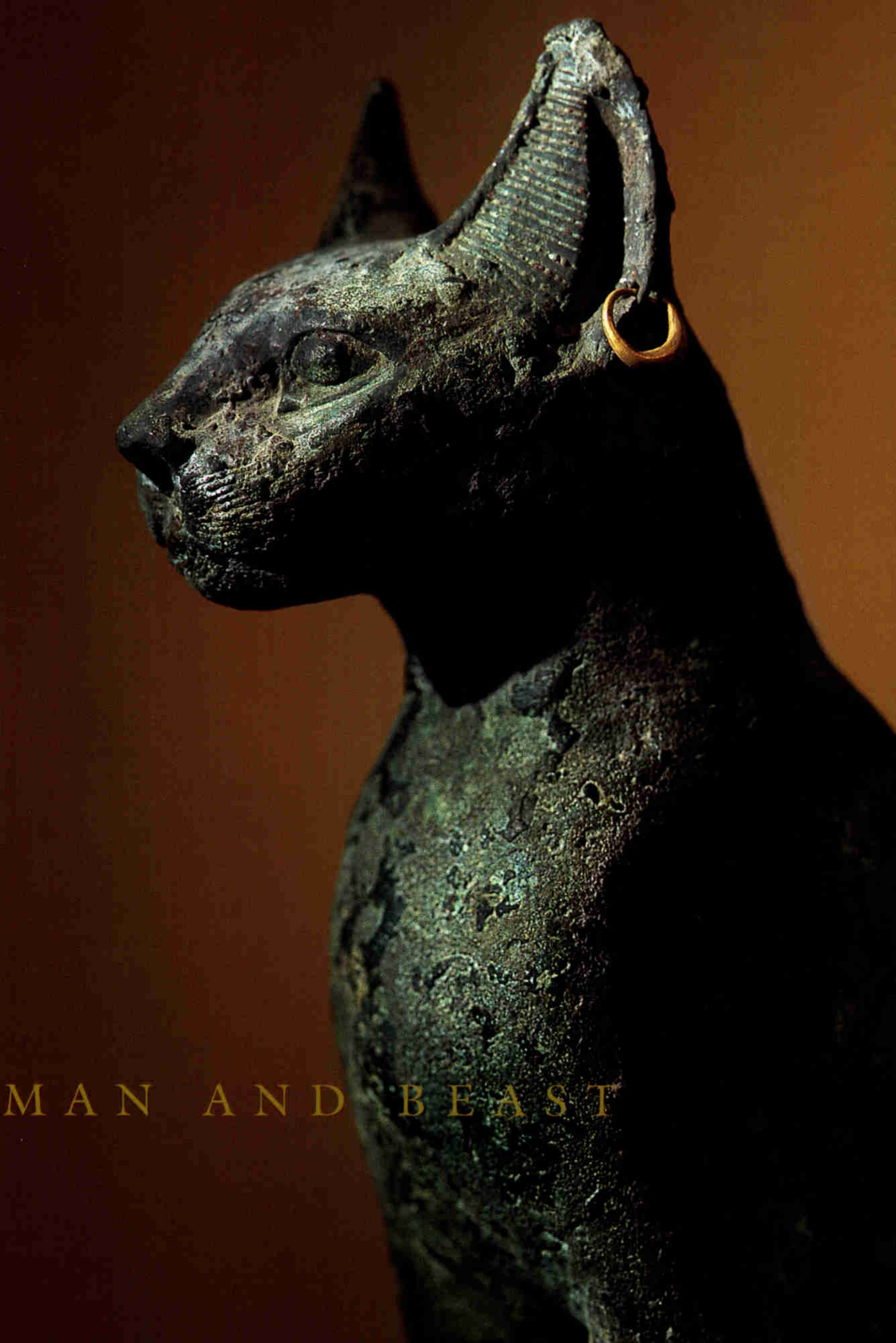
GOLDEN PAST





A GRAND DEBUT FOR

ELEGANT SIMPLICITY elevates two statues from artifacts to enduring works of art. Life chiseled from limestone, an anonymous man was resurrected from a noblemen's cemetery near the Pyramids at Giza. Curiosity cast in bronze, a cat representing the goddess Bastet arose from the ruins of Bubastis, center of the goddess's cult and the burial place of thousands of sacred cat mummies dating back as far as 950 B.C.



MAN AND BEAST

CACHE OF A YOUNG KING





UNSEEN SINCE THE 1920s, when Tutankhamun's tomb was excavated, gold foil from a horse's harness (above) shows the young ruler practicing archery. Chief conservator Nadia Lokma rediscovered it boxed in a storeroom at the museum. In her office Lokma and her team fix two of Tut's intricate wooden boats (top), also taken from storage. "The artists who made these worked with love," she says. Tut's ivory headrest (left) and a wooden goose on her alabaster nest (right) came from one of the museum's packed galleries, where they were essentially invisible amid Tut's flashier wealth. "I walked by hundreds of times and never saw them," says photographer Ken Garrett.



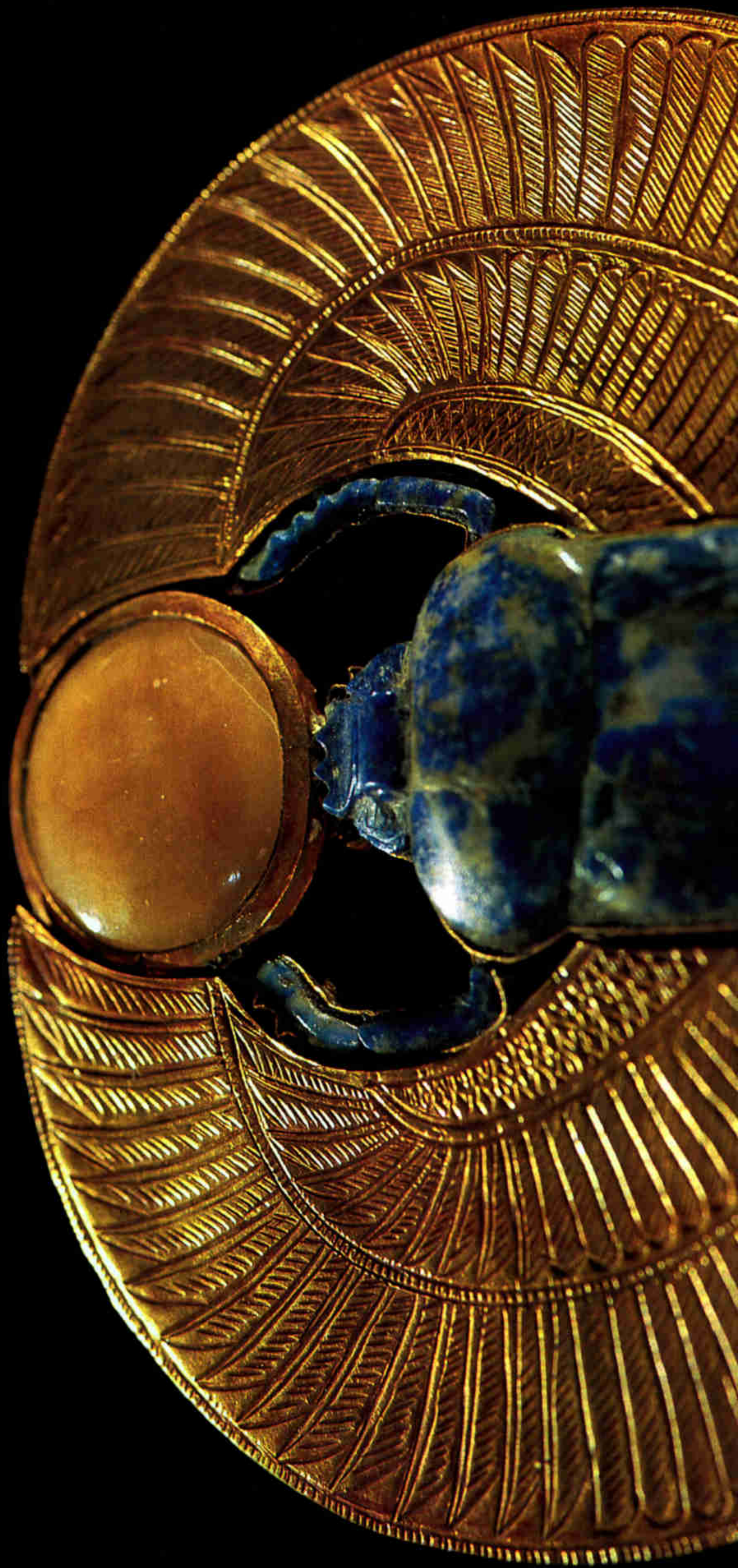


ONCE LOST IN PLAIN

KING TUT'S CROWN JEWELS, overwhelmed when displayed in the museum near his resplendent coffins, now shine with new luster on their own. Gold sets off semiprecious stones and colored glass in pendants (above and below) and a brooch (right). "Thousands of artifacts came from Tut's tomb, and most are unknown to the public," says Hawass. "This is the only museum in the world that can bring the history of archaeology alive with the rediscovery of masterpieces like these." □

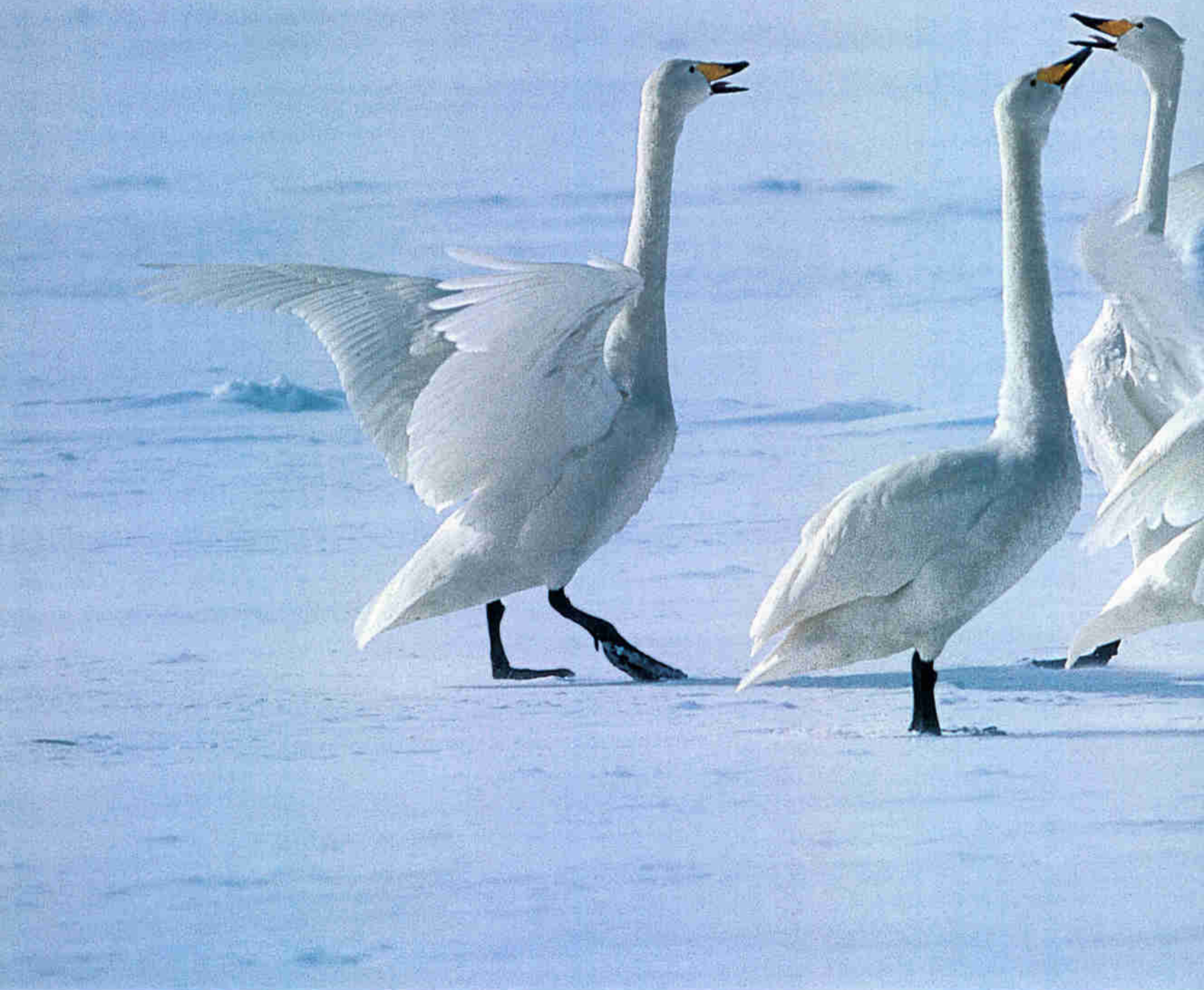


SIGHT



霜
FROST

WHEN THE FROST



Whooper swans split the still winter air on a frozen lake in Hokkaido, northernmost of Japan's big

LIES WHITE



JAPAN'S WINTER WILDLIFE

islands. It's one of the snowiest places on Earth, with beauty as dramatic as its climate.



Red-crowned cranes, known in Japan as tancho, stir from slumber in the Setsuri River. Hokkaido's



cranes might have gone extinct in the harsh winter of 1952 had farmers not saved them with gifts of grain.





As snow falls, a red-crowned crane comes in for a landing. Mates for life, a pair of cranes reinforce their bond with a “unison” call. From a few dozen in the 1920s to almost 900 now, Japan’s cranes have rebounded even as their habitat dwindles.

IN OTHER SEASONS



there might be 20 of us and only a few of them. But now, in the heart of winter, there are 20 of us and 150 of them. We are *Homo sapiens*, a gaggle of bird-watchers, scientists, and photographers; they are *Grus japonensis*, the rare and celebrated red-crowned crane.

The field is white and the wooded edges dark with evergreen. Out in the open in the fine snow of Hokkaido cluster the great white cranes, the black tertial plumes of their broad wings arranged over their rumps like elegant bustles. Known in Japan as *tancho* (red peak), the red-crowned is the second rarest crane species, after the whooping crane, with a world population of fewer than 2,500 birds. It is in other seasons fiercely territorial, but now the birds are gathered in one clangorous flock to scoop up the winter feed laid down for them by farmers. Some stalk the field or stand in pairs, lifting their bills to trumpet a shrill, rolling cry, a “unison” call that carries across the fields. One flares its wings and arches its back in a dramatic threat display to relieve the tension of crowding. A swoop of six arrives on motionless wing from their roost site in a nearby river, drop lightly to the ground amid the others, and lower their heads to pluck the scattered corn, flashing their brilliant caps of crimson like blood on snow.

The Japanese have a word, *aware*, for the feelings that arise from the poignant beauty of an ephemeral thing. The word refers not to the fragility or loss of the thing itself, but to the human feelings evoked by its passing. Those of us pressed against the rail are elated and grateful for this close look at the cranes concentrated here like a vision—and which, like a vision, may just as quickly vanish. No wonder people fly halfway around the world, board buses and trains and ferries, and wait patiently in the heavy snow to see these birds gather to preen and flare and dance their wild courtship dances. No wonder the crane is revered by the Japanese and so admired that their art never tires of representing it.

Only in Japan’s winter does this spectacle occur, and others as well, a striking assemblage of animals, from cranes and eagles to snow monkeys and sika deer, that endure the season’s hard tenancy in small refuges, natural and man-made, on Hokkaido and in the mountains of Japan’s main island, Honshu. Some of the animals that take shelter in these spots are abundant, even overabundant; others are rare, having been hunted to the brink of extinction or chived out of their last natural redoubts by human pressures. Some are in the winter of their existence and endure only through the courageous efforts of a few people working against great odds.

The concentration of these creatures in small shards of habitat on a crowded island nation creates scenes of startling beauty—and sometimes, startling



conflict. I've come to Hokkaido to learn what lessons might underlie these spectacles, what they might teach us about wildness and survival and the riddle of our own relations to nature.

TO REACH JAPAN, I flew over the top of the Earth, over the white landscapes of the Yukon, Alaska, and the bright, shining Kamchatka

Peninsula. From 35,000 feet the January landscape was a frozen blank, and I imagined how the razor of winter pushes the wild animals down there to the edge, making extraordinary demands on energy, stripping away all that is ornamental and superfluous. In places with rigorous winters, at high elevations and high latitudes, wild things deal with the food scarcity and cold of the season in two ways: Some retreat from it—either by hibernating, slipping into deep sleep or torpor to reduce the body's metabolic needs, or by migrating, leaving behind the frigid land, often at great energy cost. Others stay put and confront the challenges of a frozen domain, taking a stand within it and discovering its hidden resources, sometimes with astonishing ingenuity.

With peaks over 10,000 feet, and a long archipelago reaching northward to latitudes of 45° N, parts of Japan experience harsh winters, made more so by chill northwesterly winds that sweep across the Sea of Japan from Siberia, picking up abundant moisture along the way.

Hokkaido, the northernmost of the nation's big islands, is among the snowiest places on Earth. Its wildlife must weather long cold winters and snow that may begin falling in October and melt away only in late spring. From above, the island looks like a great ray, with its mouth to the east in the North Pacific and its tail to the west in the Sea of Japan. Volcanic action here has created a landscape of dramatic mountains and deep crater lakes, and traces of that action—old and new—are everywhere apparent, in old lava, tuff, pumice, and basalt; in steaming fumaroles and bubbling hot springs, which supply refuges of warmth for animals in winter. In her 1880 book, *Unbeaten Tracks in Japan*, British traveler Isabella Bird wrote, Hokkaido “is to the main island of Japan what Tipperary is to an Englishman, Barra to a Scotchman, ‘away down in Texas,’ to a New Yorker—in the rough, little known, and thinly peopled.”

Today Japan still considers Hokkaido its last frontier. The island's history of development is short, beginning only in the mid-1800s with the Meiji Restoration. Before that it was known as Ezo and inhabited by the indigenous Ainu people. With the restoration it received its new name and waves of new settlers, who planted rice fields wherever they could. But compared with Honshu, Hokkaido is still thinly peopled, with a fifth of the nation's land area but only 5 percent of its population. Parts of the island are as developed as any place in Japan, but pieces of it remain open



Moonset marks the sun's rise on Japan's Hida mountains in the Nagano region of Honshu. This is the land of the Japanese macaque, or snow monkey, the northernmost non-human primate on the planet.

and wild, serving as the winter haunts of some deeply intriguing creatures.

My plan was to travel to some of these wild corners, east from the domain of the red-crowned crane near the city of Kushiro, then along the Pacific coast to the Shiretoko Peninsula, a long, thin finger of wild land that juts into the Sea of Okhotsk, and from there back to the heart of winter crane country. My companions and guides would be Noriyuki Aoki, a young wildlife biologist, and Yulia Satsuki Momose, coordinator of the Tancho Protection Unit—a private foundation for the study of cranes—and one of Hokkaido's powerful voices for the preservation of wild land.

On a day that is fair and free of weathers, Yulia takes me to Kushiro Mire, an impressive sweep of boreal marsh 45,000 acres in area, surrounded by hills and shaped, she says, “like the palm of a great hand.” Japan's largest remaining marshland, Kushiro Mire was spared the fate of the nation's other wetlands because of the region's cool, foggy climate, which won't grow rice. It is the heart of the red-crowned crane's breeding grounds and the refuge where nearly all of the island's cranes congregate in winter. This time of year, the *yachibozu*, fen tussock, and *kitayoshi* reeds poking up from the snow are all brown, but in late summer their deep emerald green makes a vivid backdrop against which the tancho looks whiter than snow.

“Before the restoration, these birds were found in abundance in Honshu and Hokkaido,” Yulia says. “Some of the cranes here in Hokkaido may once have migrated to warmer places in Honshu to overwinter. But hunting and the disappearance of their habitat forced all the cranes out of Honshu.”

By the turn of the past century, even the cranes in Hokkaido were thought to have been lost to extinction. Somehow, a handful of the birds clung to a fragile existence deep in Kushiro Mire, roosting and feeding in the icy



waters of small rivers. In 1924 they were discovered, and part of the marsh was designated a protected area. But three decades later the population still hovered at only 33 birds. Then, in the winter of 1952, Hokkaido suffered a bout of severe cold and blizzards. Local farmers found the cranes nearly starved and began to feed them corn and buckwheat. Every winter thereafter, they fed them, first at farms scattered around the countryside and more recently at four established feeding stations and several satellite feeding stations



throughout eastern Hokkaido. As a result of the winter feeding, the number of Japanese cranes has risen to nearly 900.

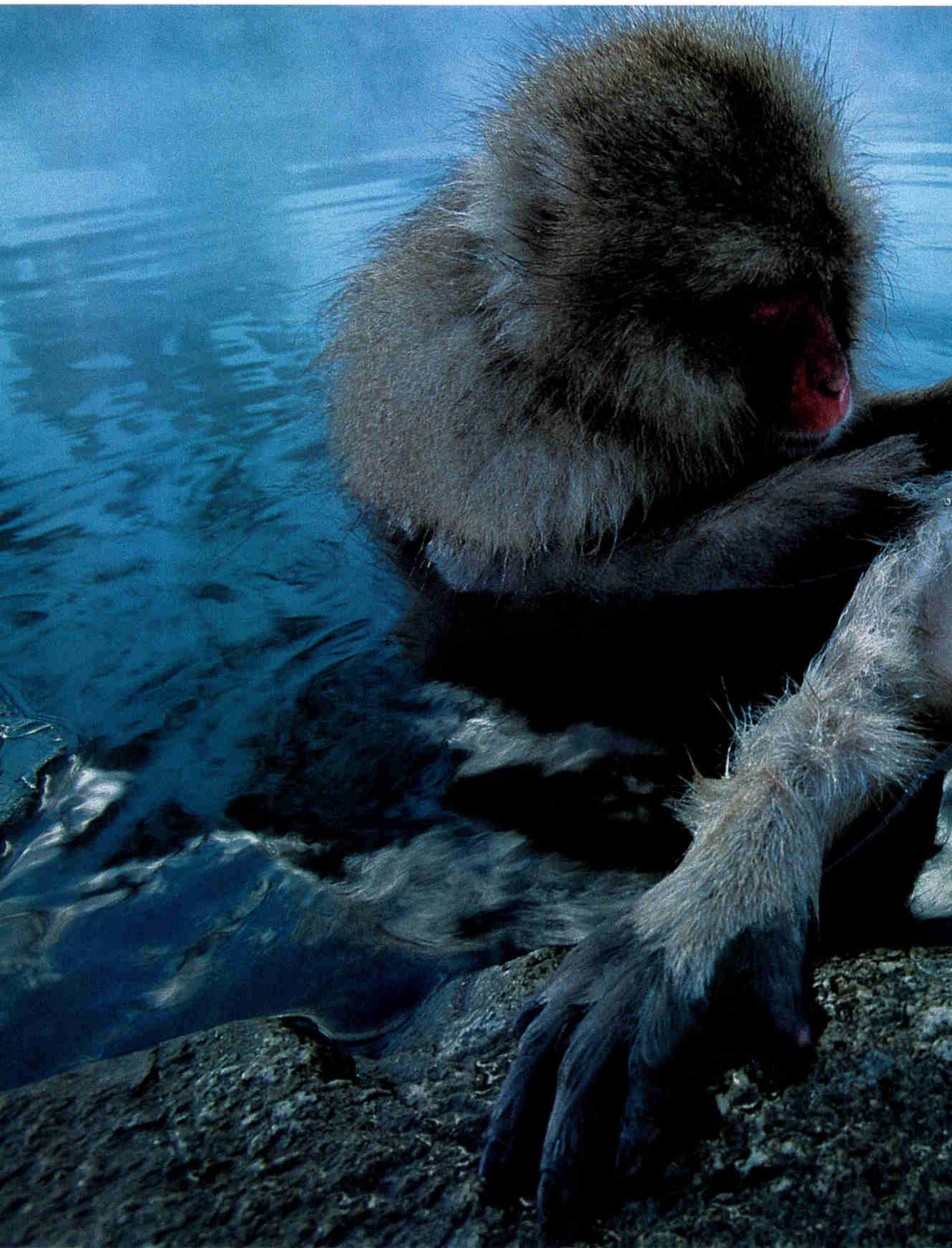
Yulia came to Hokkaido more than 40 years ago when her late father, Shoichiro Satsuki, who had grown up on the island, returned to practice medicine in his native landscape. “He came back because he loved the land here,” Yulia says, “and he threw his support to scientific studies of the ecology of eastern Hokkaido, especially of the crane and its habitat.” When the family arrived, the eastern region of the island was mostly broad, reedy swampland. Over the past half century, however, Kushiro Mire has been radically reduced. “If you fly over the area, which I’ve done many times,” Yulia tells me, “you see how little is left.” Though part of the marsh was made a national park in 1987, it remains under threat from roadbuilding, the channeling of rivers, expanding farmlands, and a hundred other troubles.

As we travel east, away from the great marsh, the sun glances off snowy farm fields and remnant pockets of marshland. A rough-legged hawk hovers over a stand of reeds and sedges, white-tailed sea-eagles perch on the telephone poles, and everywhere circle scavenging black kites. Yulia points out the site of a new crane nest she found three years ago, tucked into a patch of vestigial marsh by the road. “We were so excited—there are not many new nests built. But so far this one has not been successful.”

The land here marked the father; it has marked the daughter as well. Trained in the United States as an immunohematologist, Yulia has given over her professional life to the red-crowned crane. She and her husband, Kunikazu Momose, an ornithologist at the Yamashina Institute for Ornithology and an authority on *Grus japonensis*, study the bird year-round with the assistance of Hiroyuki Masatomi of Senshu University, taking censuses of its winter populations, conducting aerial surveys of its breeding grounds, banding individuals to learn about their movements and life cycle.

What they have learned is sobering. While the crane population in Japan is slowly increasing, at an average rate of about 5 to 7 percent each year, its habitat is rapidly shrinking, which will ultimately limit its numbers. Some 90 pairs of cranes now nest in Kushiro Mire—“probably more than the marsh can handle,” says Yulia. With the decrease in the marsh area, the density of breeding has increased, explains Masatomi, who has studied the crane and its behavior for almost 40 years and is considered its

In a park just over the hill from Nagano’s Olympic snowboard course, a snow monkey bears her son and dreadlocks of snow. With determined frolic, young snow monkeys earn their name making snowballs when the mood hits.



Monkey see, monkey do: Forty years ago a macaque jumped into a hot-spring pool and liked it. The



monkeys in this troop have been hot-tubbers ever since, much to tourists' delight.



In silhouette, a leaning pine on stone defines Honshu's Rikuchu Kaigan National Park, a cavalcade of eroded cliffs bathed in Pacific waters and alive with seabirds like the cormorant above. A Hokkaido squirrel (opposite) is well furred for winter in the volcanic Akan National Park.

Island. Several years ago Yulia suggested to Japan's Ministry of the Environment that it explore the possibility of transferring pairs of cranes there to expand their range. "It's unnatural, and risky, to have the whole population of cranes concentrated in the Kushiro area," Yulia says. "Bringing the birds together at feeding stations increases the risk of catastrophic mortality if disease were to strike. These birds can survive on their own, even in winter—if they have good habitat." But Yulia's idea never came to pass, in part because of tense relations between Japan and Russia, which have yet to resolve their decades-old dispute over ownership of the Kuril Islands.

FOR MORE THAN A THOUSAND YEARS the Japanese have written the tancho into poems and folktales and myths. They have painted it and made statues and sculptures of it. They have revered it as a symbol of long life, happiness, good luck, fidelity. From its life habits they have drawn phrases and metaphors to describe their own behavior. They have imitated it and tried to dance as it dances. They have caught and killed and eaten it, almost to the point of extinction. They have named cities and streets after it. They have folded it into tiny birds of paper and hung them carefully in colored festoons at temples and shrines and on the stone monuments to Hiroshima in Peace Memorial Park. They have made it a national treasure. They have captured, marked and released it, tracked it and spied on its habits and behavior. They have fed it. They have tried to raise it in captivity for release and failed. Most of all, they have made it into an icon and put its image everywhere, so that this extremely rare bird is, ironically, seen throughout Japan—on teacups and trays and fans, on lampposts and bridges, on wedding cards, kimonos, and cakes, on the backs of thousand-yen notes and the tail fins of jets.

The story of the red-crowned crane in Japan is emblematic of other animals. Though the nation's knowledge of nature and its reverence for animals are ancient, its efforts to protect wildlife are relatively young. Since the early 20th century Japan's Agency for Cultural Affairs has designated certain plants and animals as "natural monuments," cultural assets of the people. The designation protects various species under special laws, which prohibit their destruction except when they infringe

foremost expert. "Ten years ago, there were two nests in each ten-square-kilometer area; now there are four or five. Because the birds are territorial, this crowding can reduce the number of surviving chicks. While the adults fight to defend their territory, the chicks are left vulnerable to predators—foxes, eagles, crows."

A few crane pairs that winter in Hokkaido have begun breeding in the nearby Kuril Islands. There is other good breeding habitat just to the north of Hokkaido in the wild, open marshes of Sakhalin

on human enterprise. Today there are close to 200 species that rank as monuments, from the red-crowned crane to the goatlike serow.

But monument status does little to protect an animal's rich biological context. Nor does it guarantee any government commitment to the study of its ecology. Often completely overlooked is the fate of the animal's habitat, the old-growth forest or sedge-and-reed wetland that harbors thousands of other species that may be critical to its well-being.

The first of Japan's national parks were created in 1934 not for the benefit of wildlife but for physical fitness and other recreational activities. These days the 28 national parks and 55 so-called quasi-national parks fall under the umbrella of the Ministry of the Environment, whose mission is to

secure "the coexistence of people and nature." But "the primary purpose of the parks is still to draw people and to create a source of revenue for the area," says Masaaki Kohmaru, who served with the government's environment agency for 25 years. Some of the national park land is privately owned and, according to the official literature of the ministry, management of the parks "requires consideration of people's property rights and various industrial activities in the areas concerned." At Kushiro Mire, says Yulia, "you can still get permission to drain and develop, depending on who you know."

"We are a tiny land," explains Kohmaru. "Unlike America, we don't have any place where no one lives, so we have to make compromises."

Recently, the government has made efforts to protect habitat devoted to a few species, including the red-crowned crane and Blakiston's fish-owl. Also known as Blakiston's eagle-owl, or *shima-fukuro*, it is arguably the largest of the world's owls and one of its most endangered. But Yulia fears that it may be too late for some species, including the fish-owl. "There are not many of these birds left," Yulia tells me, as we head toward the owl's haunts at the eastern edge of the island. "And you'll see why. Most live in an area once called Nimuro, an old Ainu word meaning 'the place of many trees.'"

Just after sunset on the bank of a small river near the city of Nemuro, we are waiting for the appearance of *shima-fukuro* at a feeding station, a small raised wooden platform set on a pole not far from the river. With us is the world's expert on the fish-owl, Sumio Yamamoto, who has brought fish for the owls' evening feeding and put it on the platform. A tall, wry man in his 50s, Yamamoto has studied the fish-owl for 30 years. There was a time when the bird was found all over Hokkaido, he explains, as far west as Sapporo. But changes in the 19th and 20th centuries—the cutting of old-growth trees, which are the nesting sites for these owls, and the construction of dams and channeling of rivers, which eliminated most native fish runs—have reduced its numbers in Japan to only 130 birds.

The sky darkens, and the fish sits. I don't know how long we wait in the dark, talking in low voices and blowing on our hands for warmth. A quarter moon rises, just enough to set the snow glowing. We stop our chatter and listen. A few minutes later we hear a deep sonorous *bo-bohhh*, the call of a male fish-owl, then the female's plaintive one-note answer,

SNOWY PEAKS AND STEAMING
SPRINGS ARE THE DRAMA OF JAPAN,
BUT ITS MYSTERIES ARE ITS WILD
CREATURES PERSISTING AGAINST THE
SLIM MARGIN OF WINTER.

SNOW



*boh*hh. Then again, *bo-boh*hh. *Boh*hh. So tightly timed is the duet that it sounds like one bird delivering a three-note call.

To the Ainu people the fish-owl was a god of many names. It was Kunneriki, “the god crying at night”; Kotan Kuru Kamui, “the god who protects villages”; and Moshiri Kuru Kamui, “the god who protects the country.” The owl’s English name comes from Thomas Wright Blakiston, a British soldier, businessman, and amateur naturalist who lived in Hokkaido in the second half of the 19th century. Ironically, Blakiston may have had a hand in undoing the owl’s woodlands. In 1861 Blakiston traveled to Siberia with equipment for lumbering, intent on harvesting

the abundant trees on the Siberian coast of the Sea of Okhotsk—only to find that the Russian government would not grant him permission to cut. So

THE JAPANESE HAVE A WORD, *AWARE*,
FOR THE FEELINGS THAT ARISE FROM THE
BEAUTY OF AN EPHEMERAL THING.

AWARE

he went on to harvest the rich forests of Hokkaido, first in Hakodate, and, when timber grew scarce, in the island’s eastern reaches.

To replace nesting sites lost in the demise of old-growth trees, the Japanese government has provided more than a hundred nesting boxes. Yamamoto and his colleagues have built several feeding stations to help the owls overwinter. So far, several owl pairs have taken to these man-made solutions to man-made problems. But scarcity of habitat remains the chief factor limiting the population’s growth. “These birds are territorial,” Yamamoto explains. “When a chick grows up, it needs to find its own nesting territory. It does so by flying perch to perch for short distances. Around here, there’s no habitat left that is not occupied by other owls, and there are few trees connecting one wooded area to another.”

Farther north, on Shiretoko, there are larger forest areas well suited to the fish-owls. Yamamoto has been planting trees along riverbanks to create corridors of green all the way to Shiretoko—“a big dream on a small scale,” he says, which will take 50 or 100 years to complete.

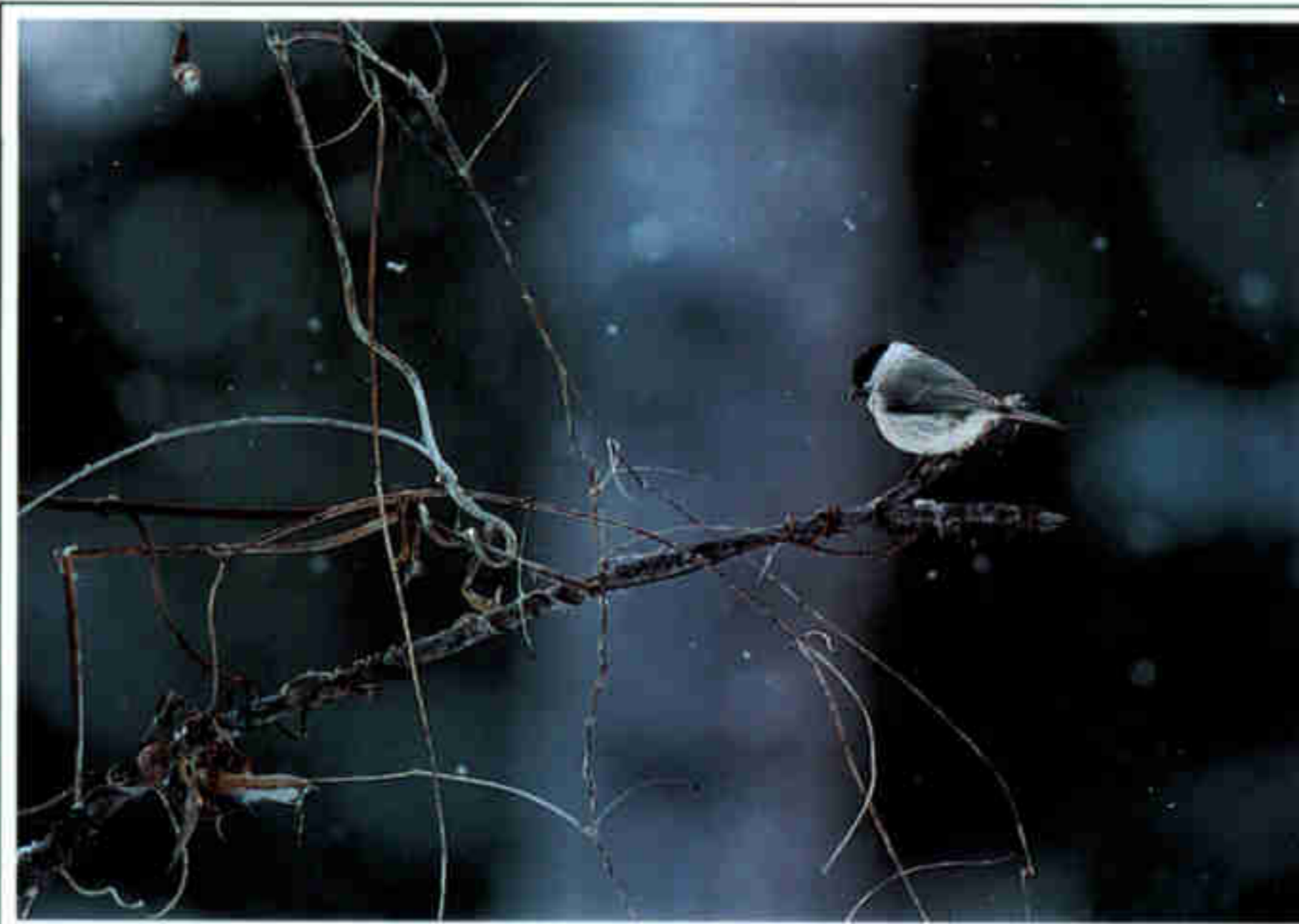
The next morning low clouds scud across a gray sky. Yamamoto leads us into a protected area set aside for the owl, a small stand of second-growth trees not far from Nemuro. The quiet is broken by the hoarse calls of jungle crows and the crunch of our boots along the snowy trail winding among the young Japanese oaks and elms, the occasional slender birch, ash, and alder. I wonder what this world must once have looked like, giant old-growth spruces and firs a hundred feet high and several feet thick. But there, in a spindly elm, Yamamoto spots an owl chick, memorable by itself for the intensity of its wild gold eye; then in another tree, another chick. Then the female, mother of the chicks, flies across our line of vision; and there, not far from her, perched on a thin limb of a young oak tree, is her mate, a magnificent creature, his great ear tufts alert to the impertinent crow hovering and croaking above his limb.

Four shima-fukuro in one morning—3 percent of Japan’s population. I am moved, and Yulia is too. For all her wanderings in the woods and marshes of Hokkaido, she has never seen a family of fish-owls in the wild. This, too, is a spectacle of its own kind, less like the raucous, ebullient epic of the flocking cranes and more like haiku.

That afternoon we travel north in the snow to see Shiretoko, one of Japan’s last real wilderness areas, and witness some of the mixed effects



of wildlife protection efforts. Shiretoko is an Ainu word meaning “the end of the Earth,” and the area is well named, with high mountains blanketed by old-growth forest, clear rivers and lakes, and a sheer, dramatic coastline of black volcanic rock and steep waterfalls, carved away by the grinding action of the ice floes that drift down from the north in winter. The northern part of the peninsula is designated as national park and serves as a refuge for some of the country’s rarest creatures—fish-owls, Steller’s



sea-eagles, brown bears, Steller sea lions—and also, for some of its most abundant animals, including the sika deer.

Along the steep slopes at the base of the peninsula, herds of the deer are grazing on the sparse vegetation emerging from the snow. The sika is a forest deer with large moist eyes and a strange, haunting whistle. In the past 20 years the population has exploded. Great herds graze and forage nearly everywhere in eastern Hokkaido, defoliating trees and damaging crops. After 1888 hunting of the sika was banned. With no natural predators to keep it in check, the population surged so dramatically—numbering more than a hundred thousand in eastern Hokkaido alone—that it came to be viewed as a pest, and hunting was again permitted to cull the population. Similar protective measures have also backfired with natural treasures such as the Japanese macaque and the serow.

Japan is not alone in its paradoxical dilemma with deer and other wildlife. I think of Australia and its kangaroos and rabbits, the United States and its white-tailed deer. We want to turn our wild animal populations on and off like a faucet, to control the numbers so that a given species will maintain a population sizable enough to sustain itself, but small enough so as not to become a nuisance in our backyards and orchards. But nature is never so cooperative, and our efforts to boost or reduce numbers often produce undesired results. So too our stumbling efforts at compromise, at balancing our needs with those of an animal. How does a crane’s need for open wetland and solitude figure against the human desire for rice field or pasture? In nurturing or cherishing wild animals, how close can we come and still call them wild? And if an animal requires solitude and pristine habitat, can we deny ourselves the pleasure of seeing it?

FROM SHIRETOKO, our plan is to circle back to the heart of winter crane country. But first we travel through the subarctic landscape of Akan National Park in search of another big spectacle of a bird. On a cold morning before sunrise we arrive at the shore of Kussharo Lake. Before us is a dark lake of sleeping whooper swans. Kussharo is the largest calderic lake in Japan, ringed with blue volcanic hills and filled with clear water like a lake of melted snow. Because it is fed by hot springs, some parts remain unfrozen all winter so there is open water where the swans can roost at night. We have missed the great flocks of

Creatures great and small alight. Year-round Hokkaido resident, a willow tit puffs up against light snow among tangled vines (above). Visitor from afar, a white-tailed sea-eagle clasps an icy crag at sunrise (opposite), one of two eagle species that migrate to Japan from Russia.



Swan lake? Actually Kussharo Lake, where hot springs keep part of the lake from a deep freeze and



locals scatter grain for the birds nearby—creating the perfect whooper roosting spot.



Making a splash on Tofutsu Lake, a whooper swan gets a running start before takeoff (above). On touchdown it glides across the water's surface (below), its webbed toes like skis and flapping wings an air brake. A bird at rest tucks its bright beak into feathers but keeps an eye out for trouble (right).

BEAUTY





thousands of whoopers that gather in eastern Hokkaido in November and December on their way from Siberia to warmer regions on Honshu. But there are hundreds still here overwintering on the island.

In the rising light the pale forms take shape, heads tucked beneath wings, in perfect stillness. Across the water dawn breaks in the throat of a single swan, and the necks of the birds before us unfurl and pop free of their wings. One by one, they warm their bodies from sleep, swim a little, then rise into clamorous flight. They leave for their feeding grounds at nearby Sunayu; we do too—and arrive just in time. A tourist bus has pulled in, along with hundreds of swans, who are squawking and scrabbling for the food flung down by the crowds of tourists, bits of bread and chips, “things not part of their natural diet,” Yulia comments, “and not healthy.”

“Are these birds wild?” she asks, then answers herself: “I don’t think so.” Indeed, so popular are these swan-feeding sites, and so heavily used by whoopers and tourists alike, that the swans have grown tame, accepting food from the palm of a hand, and the whooper that feeds itself in winter in Hokkaido has become a rare bird indeed. “This is good for tourism,” observes Yulia. “It is not good for the swans.”

I would hear this message again in the Hida mountains of Honshu, where



Hokkaido sika deer nuzzle on the wild Shiretoko Peninsula, "the end of the Earth," jutting 40 miles



into the icy Sea of Okhotsk. In some areas of Japan sika are treated as sacred; in others, as game.

a rare and demure little bird, the antithesis of the raucous whooper, ekes out an unlikely winter existence. I never saw a rock ptarmigan in the wild; nor did I expect to. The bird lives in a fragile alpine environment of dwarf pine forest at an elevation of 7,800 feet. There its population hovers precariously around 2,000; five out of six chicks in every brood are lost to cold and predators. So remote and snowy is the ptarmigan's winter habitat, with snowfall averaging 20 feet or more a year and slopes subject to avalanches, that the scientists who study the bird must be skilled mountain climbers. One of these is Takaaki Sakanakura, an athletic ornithologist with the Evolutionary Biology Institute, who has been monitoring the population, nesting sites, and winter ecology of the species for the past two decades. In winter the ptarmigan migrates to the steepest parts of the slopes to feed on the tops of a few exposed plants sticking up from the snow. Come spring, the males gather on small pine mounds, chests puffed out, to stake out their territories with displays and an odd froglike call.

For eons the bird carried out its strange ritual in solitude in a pristine environment, but around 30 years ago, the Japanese government approved a tourist route through the ptarmigan's habitat, a combination bus-cable-car-hiking trail that "you can navigate in high heels," says Sakanakura. Each year a million tourists do just that, to enjoy the mountain views and hike among the wildflowers. They often bring their pets and leave their dirt and waste, which carry disease and draw the ptarmigan's predators—civets, ermines, crows.

"The impact of these tourists is grave," says Shoichi Kawano of the International Union for the Conservation of Nature. "Our only hope in preserving the ptarmigan lies in protecting it from human destruction by limiting the access of tourists." But so far the Japanese government has shown little interest in restricting human activity in the region.

The only ptarmigan I saw was a caged bird that had suffered injury and could not live on its own. It was a singular beauty, snow-white with a bright black eye, a messenger from another time and place, like starlight. Standing before the captive bird, I was reminded of those Japanese paintings that use a small, delicate compressed part of nature to evoke the vastness of nature's whole—the spray of flower to suggest the field, or the single wave to call up the great ocean. Most of us will never see the spectacle of a wild ptarmigan, white against white in the lash of wind on high slope. But I suspect most of us would like to know it's there, and always will be—a bird-shaped realization of winter resilience.

THE MORNING AFTER THE SWANS, we are back in crane country for one last visit, searching for a pair of cranes that are feeding themselves in a natural setting, without human assistance. Locals have reported spotting the pair somewhere in the flat pastureland near Kushiro. The report is important because it suggests that the tancho may be extending their range, not just for wintering but for breeding. "These birds have so much to teach us," Yulia tells me. "We need to know how they select and establish their territories, what they need in order to survive there. This is critical if we're going to help them expand their range."

We stop at a small shop to ask a local man whether he has seen the self-sufficient cranes, and then again, at a school. No one can report any sign of the pair. Later we see a small group of cranes—likely visitors to a



nearby feeding station, Yulia says. The birds are still roosting in the water, hunched against the cold. Relative to the air, the water is tepid, and the cranes sleep standing up in the streams, not just for warmth but for protection from predators. Each bird has its own rhythm of sleeping and waking once an hour through the night. While there is no designated “guard” bird, the group’s collective chaotic sleep cycle improves the chances that one bird or another will wake in time to see a lurking predator and send up a cry.

The birds are quiet now, but I think back to the first time I heard their call. Borne through a long, coiled trachea, the call resonates like the tube in a wind instrument and can be heard for up to two miles. The resulting sound gave rise to the Japanese expression, *tsuru no hitokoe*, “a call of the crane,” meaning a voice of authority.

Japan will not dismantle its cities or farms in favor of deer or birds. It is too late to set aside large reserves. What it can do is save and protect what remains, seek ways for marshland and farmland to coexist, support efforts to understand the ecology of its species. Japanese conservationists are working as if their country will do the right thing. I find their optimism, and their devotion to understanding natures other than our own, nearly as inspiring as the crane’s resounding cry.

The white peaks and steaming hot springs are the drama of this country, but its mysteries are its wild creatures persisting against the slim margin of winter. The red-crowned crane passes the frigid night standing one-legged in the icy stream beside a fellow crane; the ptarmigan finds food through cold, labored downslope searching. We have seen these simple mysteries of grace and survival; think of all the secrets not yet revealed. □

In a splendid can-can, a red-crowned dancer bows its head and flaps its wings—part of a movement emulated by local Ainu people in a ritual to charm evil spirits. Despite ever present threats to its survival, the crane remains Japan’s most revered animal, symbol of longevity, happiness, and luck.

WEBSITE EXCLUSIVE

Take another look at photographer Tim Laman’s portraits of the creatures that continue to weather Japan’s beautiful but harsh winters at nationalgeographic.com/ngm/0301.

ATHENS, OHIO



200 1A FUJL 2

S-200 2A F66 3

S-200 3A



45701

One Day, 114 Cameras

Lights? No. Action? Plenty. From dawn to dusk on a dismal fall day, 114 students fanned out from Athens, Ohio—home to Ohio University's Visual Communication school—to focus on 45701. Thanks to the VisCom school, this is one of the nation's most photographed zips. Click. A bus rolls, a farmer rests, a horse snorts, cans clatter, a prisoner walks, and a day is caught in the act.

27 S-200



24 S-400 24A CH-7

25 S-400 25A FUJL

26 S-400



24 S-200 24A CA-6 25

S-200 25A FUJL 26

S-200 26A





45701

POPULATION: About 5,000 residents and 20,000 students

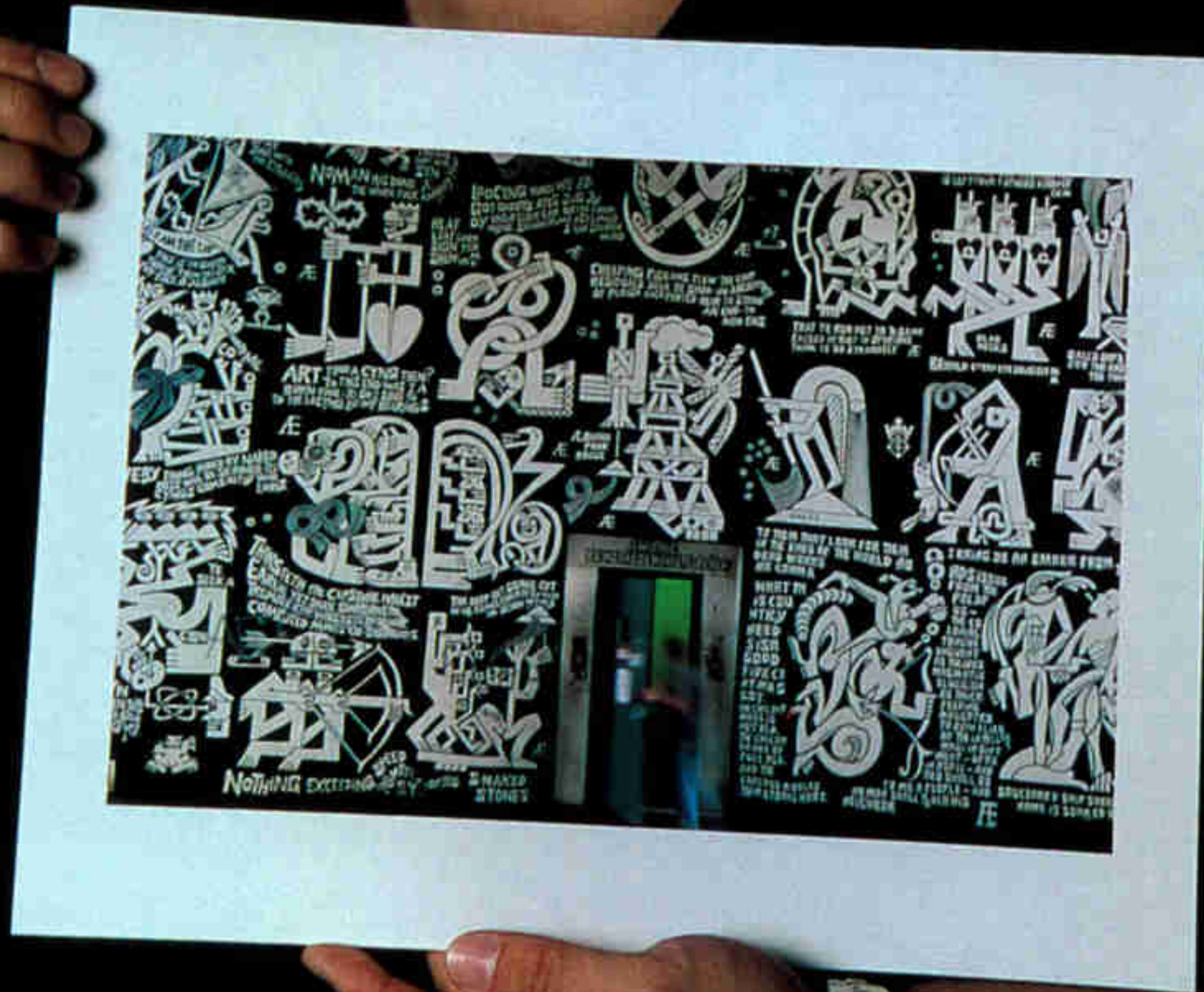
TATTOO PARLORS: 5
FRAMES SHOT DAWN

TO DUSK, OCTOBER 26: 12,000

MOST POPULAR LIBRARY ARCHIVE: The Spook File, which chronicles local reports of ghost sightings and spiritualist lore

VISCOM STUDENT

HAUNTS: Tony's; Burrito Buggy



“It was such a horrible afternoon,” student Lisa Lauck recalls. “Weather was crappy, light was crappy.” But October 26 was the day I had set aside to send out our voluntary army of photo-journalism students to document zip code 45701. As director of the VisCom school, it was my call. So they went. They left our launch meeting the night before with three rolls of color negative film and brief instructions: Engage your brain before you engage your fingers and be back at 9 a.m. the day after tomorrow for one-on-one critiques. Oh, and have fun. There would be no grades, but there was pressure. Could they beat out more than a hundred of their peers and win a place on our website and the 16-page supplement published

How could anyone *not* notice this chaos in black and white? The question intrigued student Hyunsoo Leo Kim, who shot the mural adorning a school wall. Because this art is decades old, passing students barely give it a glance. “I wanted to show how we forget the beauty right next to us,” says Kim.



by the *Athens News*? Could they improve their technique? Could they get that one memorable photograph? The weather certainly wasn't helping.

After six years of the annual Dawn to Dusk project, local residents take our invasion in stride, despite photographers occasionally colliding with each other. Residents have seen weirder things, no doubt. In our eclectic zip, farmers and other folks passionate about the land mix more or less easily with folks passionate about ideas: artists, evolutionary biologists, geophysicists. They meet for coffee in places like Hebardsville, in the foothills of the Appalachian Mountains. Some people "move to Athens and fall in love with the town and never leave," says

So what do Beetles, dancers, and tattoos say about this place? Answers spring from its beholders, who found art in the everyday.

Amy Thompson hadn't planned to spend all day at the Smiling Skull Saloon, an Athens biker bar. But, she says, "the longer I stayed, the more comfortable people got." Comfort led to candid shots. "After a while they just did their thing and let me be there. I hated to leave."



Lauck. "They do things like grow peppers and make salsa for a living."

For students the roller coaster begins at our group editing session. Nearly 150 prints (chosen by faculty from 12,000 frames shot) are taped to the walls—all creatively composed, technically polished, editorially powerful. Three hours later only 25 remain. Faculty argue and vote on each image; the students sigh and groan. Design work brings another 16-hour day. It's exhausting, but none of us leave unchanged. The day after our website goes up so many people are checking to see if they were included in our photos, the productivity of the area goes down. The students have proved that they can do that most difficult thing for a photojournalist: to capture the unique in the ordinary. □

—LARRY NIGHSWANDER

MORE INFORMATION

WEBSITE EXCLUSIVE There's more on 45701 at nationalgeographic.com/ngm/0301. Tell us why we should cover **YOUR FAVORITE ZIP CODE** at nationalgeographic.com/ngm/zipcode/0301 or mail your suggestion to PO Box 98199, Washington, DC 20090-8199. E-mail: zip@nationalgeographic.com

Final Edit



MICHAEL YAMASHITA

GREAT WALL

Horsepower

“There are few signs of the 21st century” in the tiny Chinese village of Tanyaoguo, says photographer Michael Yamashita. “There are no tractors. People rely on horses for transportation and farmwork.” He traveled twice to the Gansu Province hamlet to capture the rhythm of rural life: harvesting wheat and vegetables, herding sheep and yaks down to the river for water every morning and evening.

Yamashita was shooting street scenes at sunrise one winter day, taking advantage of the early golden light, as a horse followed a villager down the road. “Then a second horse ran into view. I caught it at a perfect moment with its front legs raised.”

“We all loved the drama of the photo,” says illustrations editor Elizabeth Krist, “but visually it was too close to the picture on pages 24-5 with the silhouette of the bicyclist moving into the center of the frame. And perhaps other photos we used in the story had more to say about village life. Sometimes it’s not enough for a photograph to be beautiful.”

WEBSITE EXCLUSIVE

Cut it or keep it? Find out what tipped the balance for this photo and send it as an electronic greeting card at nationalgeographic.com/ngm/0301.

ON ASSI

ON THE ROAD, IN THE FIELD,



GOVERNMENT

C O V E R I N G T H E W O R L D



DREAMWEAVERS

Magic Carpet Ride

This textile's ETA: Sometime in the future

No, author **Cathy Newman** and photographer **Cary Wolinsky** aren't flying over Boston. They're really just a few feet off the ground in a warehouse in the suburbs, their magic carpet supported by a curved platform. The rug is a prototype of a textile whose changeable design lights up when plugged in, thanks to fluorescent material below a patterned template. (See "How I Got the

Picture" in this section for Cary's explanation of how he created a composite image like this one.)

The high-tech textiles article had its frustrations. "We'd follow up on wonderful leads, and they'd turn out to be a figment of someone's imagination," Cathy says. Posing on a carpet wasn't easy either: "It took hours, and I have a bad back. Being a model is nothing I care to do on a full-time basis."



MICHAEL YAMASHITA

GREAT WALL OF CHINA

Monstrous Fun

At work and at play in rural China

Five-year-old Wei Jia calls **Peter Hessler**, a frequent visitor to his Chinese village of Sancha, Mogui Shushu—Uncle Monster. “We always play when I’m there,” explains Peter,

author of “Chasing the Wall.” “He likes to roughhouse, and I pretend I’m a monster” (above).

Peter lives in Beijing, about two hours south of Sancha. When he goes to the farming village (population: under 200), “It’s like going back in time. There are no shops or restaurants, and the road comes to a dead end there.” The residents trap hedgehogs and wild boar in the neighboring hills. “The last

time I went for a walk, I got trapped in a wire snare,” Peter reports. From the village, he can see a nearby stretch of the wall completed in the 43rd year of Ming Emperor Wanli, in 1615.

A former Peace Corps teacher in China, Peter returned in 1999 as a freelance writer.

“For the most part,” he says, “I travel freely in China,” a task made easier by his ability to speak Mandarin Chinese. “I’m not working for a big newspaper, and I’m not writing overtly political things. But I still travel carefully.”

For his two Great Wall trips, he rented cars and camped or stayed overnight at truck stops. Still, he ran afoul of one province’s bureaucrats (see pages 32-3). “Every time I got somewhere, they somehow knew I was coming and told me to keep moving,” Peter says. “But then I crossed the border into the next province, and I was fine.”

WORLDWIDE

The sky was a brilliant blue, two policemen rode by on camels, the pyramids loomed in the distance, and the temperature neared triple digits. **Jeanne Peters**, a magazine editorial researcher working on the article about Egyptian treasures, watched workers lift statue after statue out of a storeroom at Giza where they had rested, sight unseen, for the past 40 years.

“I kept running around and saying, ‘Look at that!’” Jeanne says. “Finally I took a break. It was very hot and humid. I had an umbrella, and I borrowed a reflector (right) from photographer **Ken Garrett**.”

Did it cool her off?

Accuracy being everything to the 28-year magazine veteran, who has worked on seven of the past nine NATIONAL GEOGRAPHIC articles on ancient Egypt, she

answered: “Maybe psychologically.”

Since Ohio University’s Dawn to Dusk photography project began in 1996, residents of Athens, Ohio, have become used to student photographers swarming around their town.

“Somebody once referred to it as gnats surrounding a community for a day,” says **Larry Nighswander**, director of the School of Visual Communication, author of this month’s ZipUSA feature, and a former NATIONAL GEOGRAPHIC photo editor.

“One gentleman has been photographed so often that he asked, ‘Don’t your professors have enough pictures of me?’”



A. R. WILLIAMS, NGS STAFF

Photographer **Tim Laman** didn’t need a guide to show him around Japan. He was born there, the son of Protestant missionaries, and attended school until leaving for college in the U.S. When he

returned to Japan to photograph its winter wildlife, he found snow monkeys near Nagano, an hour’s drive from where his family had a mountain cabin. His love of nature and his pursuit of photography began there on hikes as a teenager.

WEBSITE EXCLUSIVE

Find more stories from our authors and photographers, including their best, worst, and quirkiest experiences, at nationalgeographic.com/ngm/0301.

If You Purchased Prerecorded Music on Compact Discs, Cassettes or Vinyl Albums from January 1, 1995 through December 22, 2000

Please Read This Legal Notice

This notice is to inform you of proposed Settlements of lawsuits brought by the Attorneys General of 43 states, Commonwealths and Territories and by counsel for the Plaintiff Settlement Class entitled *In re: Compact Disc Minimum Advertised Price Antitrust Litigation*. These lawsuits, which are currently pending in the United States District Court for the District of Maine, relate to the retail pricing of prerecorded music compact discs, cassettes or vinyl albums ("Music Products").

Who is Involved?

You are a member of the Settlement Group and your rights against Defendants are affected if you are a person (or entity) in the United States and its Territories and Possessions who purchased prerecorded Music Products consisting of compact discs, cassettes and vinyl albums from one or more retailers during the period of January 1, 1995 through December 22, 2000.

Who are the Defendants?

The Distributor Defendants are: Capitol Records, Inc. d/b/a EMI Music Distribution, Virgin Records America, Inc., and Priority Records LLC; Time Warner, Inc., Warner-Elektra-Atlantic Corp., WEA, Inc., Warner Music Group, Inc., Warner Bros. Records, Inc., Atlantic Recording Corporation, Elektra Entertainment Group, Inc., and Rhino Entertainment Company; Universal Music & Video Distribution Corporation, Universal Music Group, Inc., and UMG Recordings, Inc.; Bertelsmann Music Group, Inc. and BMG Music; and Sony Music Entertainment Inc. *The Retailer Defendants are:* MTS, Inc. d/b/a Tower Records, Musicland Stores Corp. and Trans World Entertainment Corp.

What is the Litigation About?

Plaintiffs allege that the Defendants conspired to illegally raise the prices of prerecorded Music Products by implementing Minimum Advertised Price policies, in violation of State and Federal laws. All Defendants deny all claims of wrongdoing asserted by the Plaintiffs.

What are the Terms of the Settlement?

The Defendants have agreed to pay a combination of cash and non-cash consideration. Defendants' combined cash payments total \$67,375,000. In addition, Distributor Defendants will provide \$75,700,000 worth of prerecorded music compact discs.

Cash Distribution

The cash paid by the Defendants, after the payment of attorneys' fees, litigation and Settlement administration costs, shall be distributed to consumers who purchased Music Products. The number of claims filed will determine the actual amount of the individual refund but will not exceed \$20.00 per claimant. If the number of claims filed would result in refunds

of less than \$5.00 per claimant, there will be no cash distribution to individual consumers. Rather, the cash portion of the Settlement shall be distributed to not-for-profit, charitable, governmental or public entities to be used for music-related purposes or programs.

Non-Cash Consideration

The compact discs will be distributed in each State or Territory to not-for-profit, charitable, governmental or public entities to be used for music-related purposes or programs reasonably targeted to benefit a substantial number of persons who purchased prerecorded music compact discs, cassettes or vinyl albums from one or more retailers. The amount of product each State receives will be in proportion to that State's percentage of total population of the United States and its Territories and Possessions.

All Defendants have also agreed to various injunctive provisions relating to the adoption and implementation of certain types of retail advertising and pricing policies.

What are my Legal Rights?

How to Remain in the Settlement Group

If you are in the Settlement Group, you do not need to take action to remain a member, although to share in the Settlement Fund you must file a Claim Form as discussed below. If the Court approves the proposed Settlement you will receive the benefits of the proposed Settlement and you will be bound by all orders and judgments of the Court and your claims against the Defendants for the conduct alleged in these actions will be resolved and released.

How to File a Claim

If you wish to file a claim you must request and complete a Claim Form by calling the toll-free number or writing the Claims Administrator. Or, you may file a claim online (see below). Claim Forms must be signed and postmarked no later than March 3, 2003.

How to Not Participate in the Settlement Group

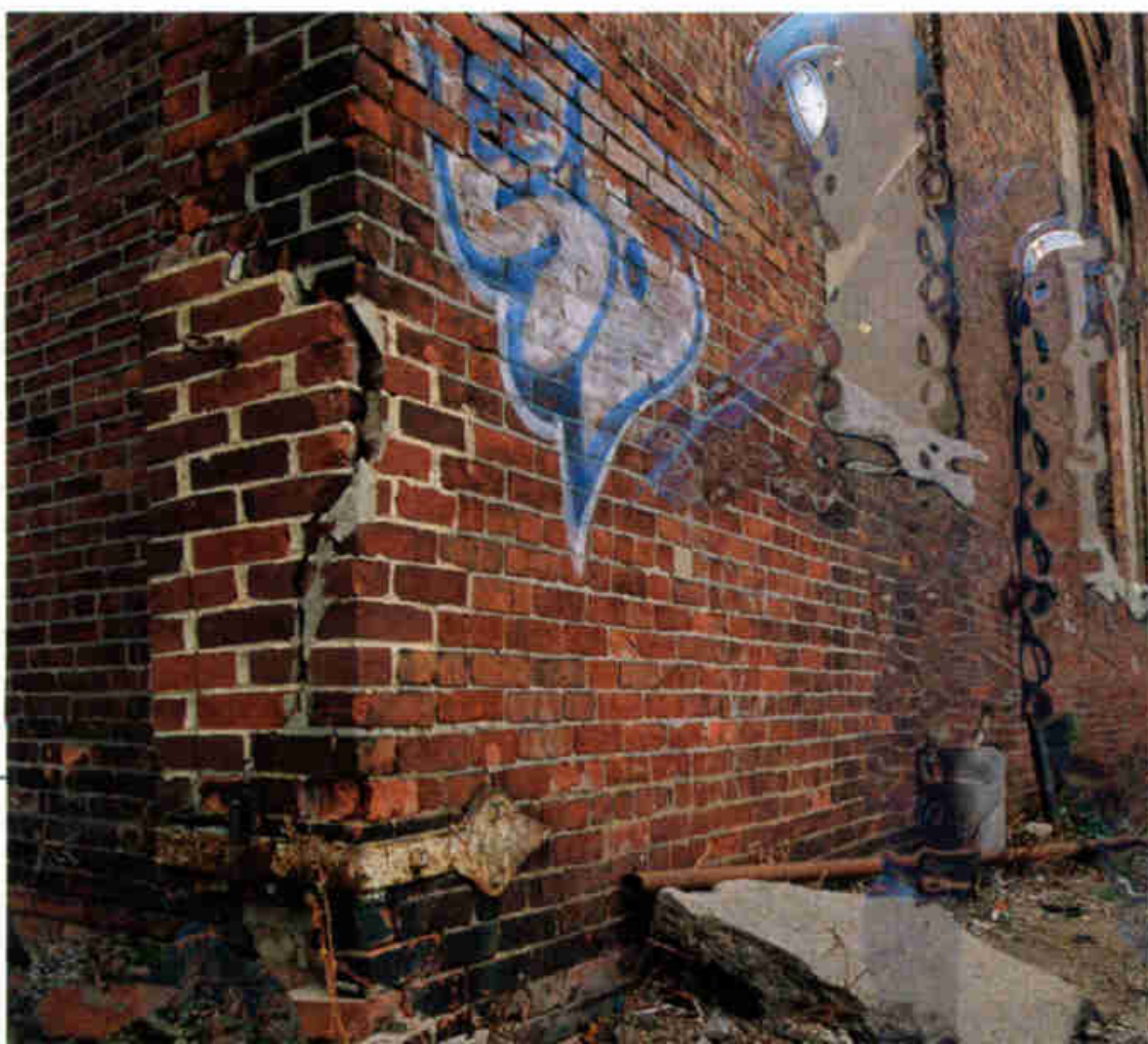
If you do not wish to be a member of the Settlement Group, you may exclude yourself by writing to Counsel as outlined in the Notice of Pendency (see below). Your request must be postmarked no later than March 3, 2003.

The Court will hold a Fairness Hearing to determine if the proposed Settlement is fair, reasonable and adequate on May 22, 2003, at 10:00 a.m. in Courtroom 2, United States Courthouse, 156 Federal Street, Portland, Maine 04101. If you remain a member of the Settlement Group you or your counsel have the right to appear before the Court and object to the Settlement. However, you must file a Notice of Intention to Appear and Object as outlined in the Notice of Pendency. Objections must be filed by March 3, 2003.

For Information on the proposed Settlement, your rights and a copy of the Notice of Pendency and Claim Form:

Visit: www.musiccdsettlement.com Call: 1-877-347-4782

or Write: CD Claims Administrator, P.O. Box 1643, Faribault, MN 55021-1643



HOW I GOT THE PICTURE

Making the Invisible Visible

The Future Warrior invades Boston

“I’d love to show you, but I can’t.” In the nudge-nudge-wink-wink, super-secret world of high-tech textiles, that’s the answer I got whenever I asked, “So, when do I see a sample?”

Among the people who have legitimate reason to be tight-lipped about their project are the scientists at the U.S. Army Soldier Systems Center in Natick, Massachusetts, who are building uniforms for the Future Warrior program. But they eagerly described their goal—making a light-transmitting textile that will render a soldier virtually invisible against any background.

Invisible? How could I photograph that?

I found my “war zone” background in the alleys of Boston’s old fish markets (top). Back in Natick, I had Sgt. Joseph Patterson squeeze into a mock-up of the Future Warrior uniform and strike combat poses in front of a blue screen (middle). Blue makes it easy to use a computer to produce a clean cutout of Joe that can be flopped and sandwiched with another photo. Digital artist David Deranian then replaced most of Joe’s uniform in the image with part of the brick wall photo, and distorted it to get a wavy look. The camouflaged cutout of Joe almost disappears when digitally pasted onto the background (bottom).

—Cary Wolinsky

Flashback



WILLARD R. CULVER

DREAMWEAVERS

New Rubber for Spare Tires

Two women model Firestone's entrée into the world of fashion: undergarments made with Controlastic, an elastic yarn made of rubber ("Our Most Versatile Vegetable Product," said NATIONAL GEOGRAPHIC in a February 1940 story). The tire company debuted the rubber product, no longer used in today's stretch fabrics, at the 1939-1940 World's Fair with a promise that it would fulfill "that very much formfitting desire that is paramount today in so much of women's wear."

This photograph has never before been published in the GEOGRAPHIC.

WEBSITE EXCLUSIVE

You can find this image as well as access the Flashback photo archives at nationalgeographic.com/ngm/flashback/0301.

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before crossing the room.

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